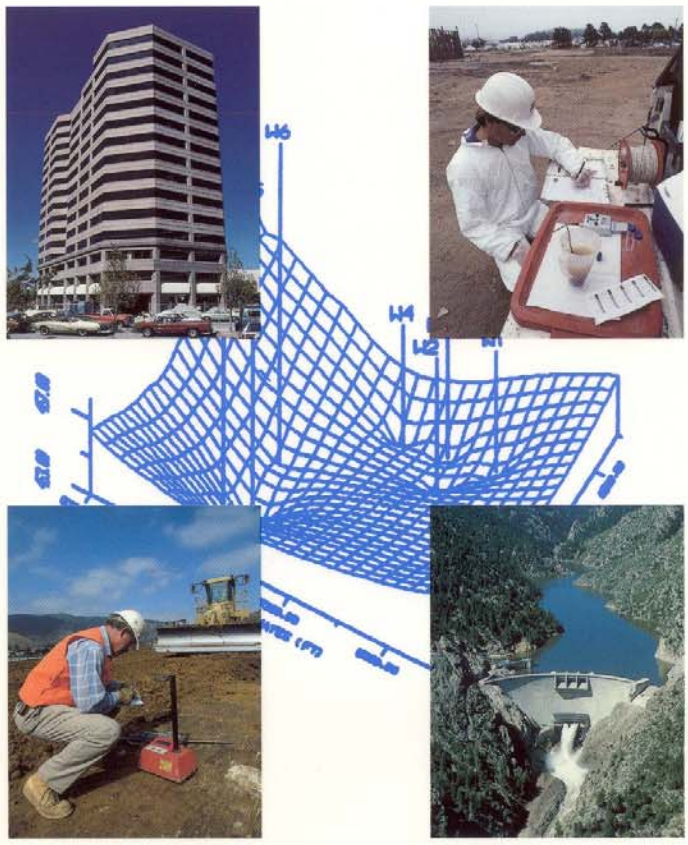
HARZA

Consulting Engineers and Scientists

SUPPORTING DESIGN REPORT FOR WETLAND ENHANCEMENTS TO IMPROVE THE WATER QUALITY OF SYLVAN LAKE



Property of
Lake and River Enhancement Section
Division of Fish and Wildlife/IDNR
402 W. Washington Street, W-273
Indianapolis, IN 46204

SUPPORTING DESIGN REPORT FOR WETLAND ENHANCEMENTS TO IMPROVE THE WATER QUALITY OF SYLVAN LAKE

September 1997

Prepared for:

The Sylvan Lake Improvement Association
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Rome City, Indiana 46784

Prepared by:

HARZA ENGINEERING COMPANY

SYLVAN LAKE ENHANCEMENT PROJECT
SUPPORTING DESIGN REPORT

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SUPPORTING DESIGN REPORT FOR WETLAND ENHANCEMENTS TO IMPROVE THE WATER QUALITY OF SYLVAN LAKE

INTRODUCTION

This Supporting Design Report summarizes the procedures, criteria, and results of analyses used for the design of a flow and sediment control structure to enhance the water quality of Sylvan Lake. The structure is designed to trap sediment and sediment-borne nutrients that now flow from Henderson Lake Ditch and from Oviatt Ditch into Sylvan Lake.

Sylvan Lake is a public recreation and scenic resource. The Project location is shown on Figure 1. Principal activities are boating, fishing and lakeshore recreation. The lake enhancement described in this report is being performed by the Sylvan Lake Improvement Association with partial funding from the Indiana Department of Natural Resource's "Build Indiana" fund.

LOCATION

The Project site is shown on Figure 2. The sediment control structure lies at the easternmost extremity of Sylvan Lake at Township 35 N Range 10 E of the 85th Principal Meridian, Section 13. The Project location appears on the USGS Kendallville, Indiana quadrangle.

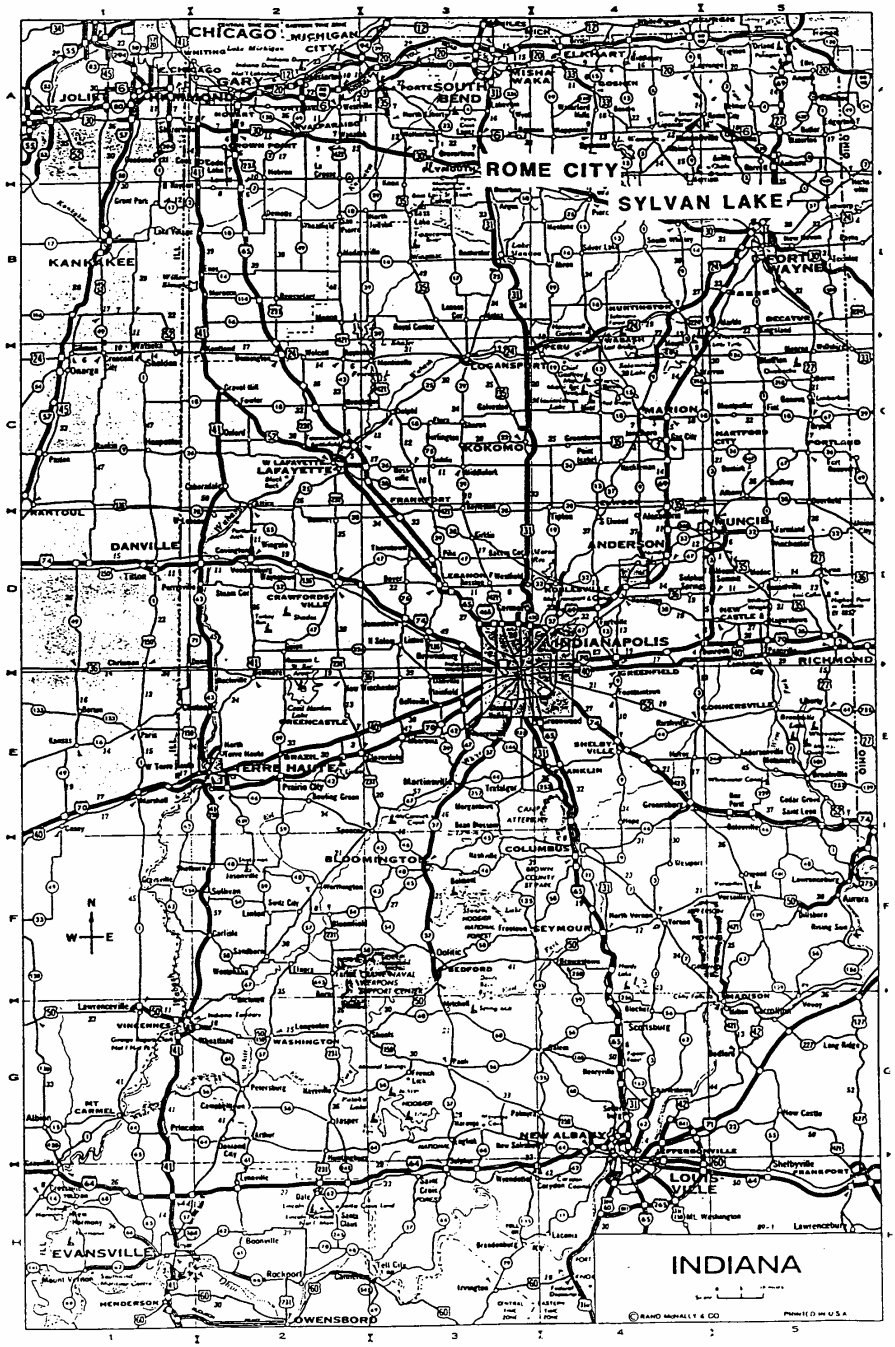
DEVELOPMENT OF THE PROJECT DESIGN

Background

A 1990 feasibility study of measures to remedy water quality impairments to Sylvan Lake recommended construction of a structure at the point where Henderson Lake Ditch flows into the Gravel Pit Basin of Sylvan Lake (Crisman, 1990). The purpose for locating the structure at this point was to improve the ability of the wetland fed by Henderson Lake Ditch and by Oviatt Ditch to capture sediment and nutrients (particularly sediment-bound phosphorus) now flowing into Sylvan Lake and contributing to water quality impairments.

Subsequent to the feasibility study, Harza modeled the Sylvan Lake watershed using the U.S. Department of Agriculture's AGNPS (Agricultural Non Point Source) runoff and pollution

Figure 1


CHICAGO
MICHIGAN CITY
GARY
SOUTH BEND
MISHAWAKA
ROME CITY
SYLVAN LAKE
KANKAKEE
FORT WAYNE
LOGANSPORT
MARION
KOKOMO
LAFAYETTE
FRANKFORT
MUNCIE
DANVILLE
ANDERSON
INDIANAPOLIS
RICHMOND
GREENCASTLE
TERRE HAUTE
BLOOMINGTON
COLUMBUS
SEYMOUR
WASHINGTON
VINCENNES
MT CARMEL
NEW ALBANY
LOUISVILLE
EVANSVILLE
HENDERSON
OWENSBORO
INDIANA
N
W
E

model. This modeling indicated that during the one-year storm approximately 842 tons of sediment are discharged at the point where Henderson Lake Ditch empties into the wetland and that approximately 972 tons (contributed by both Henderson Lake Ditch and by Oviatt Ditch) flow out of the wetland into Gravel Pit Basin. While no attempt has been made to verify these sediment volumes by field observations, the modeling does show that the closer the point for controlling sediment and nutrient loadings is located to Sylvan Lake, the more effective it will be in intercepting sediment, and sediment-bound nutrients, flowing toward the lake.

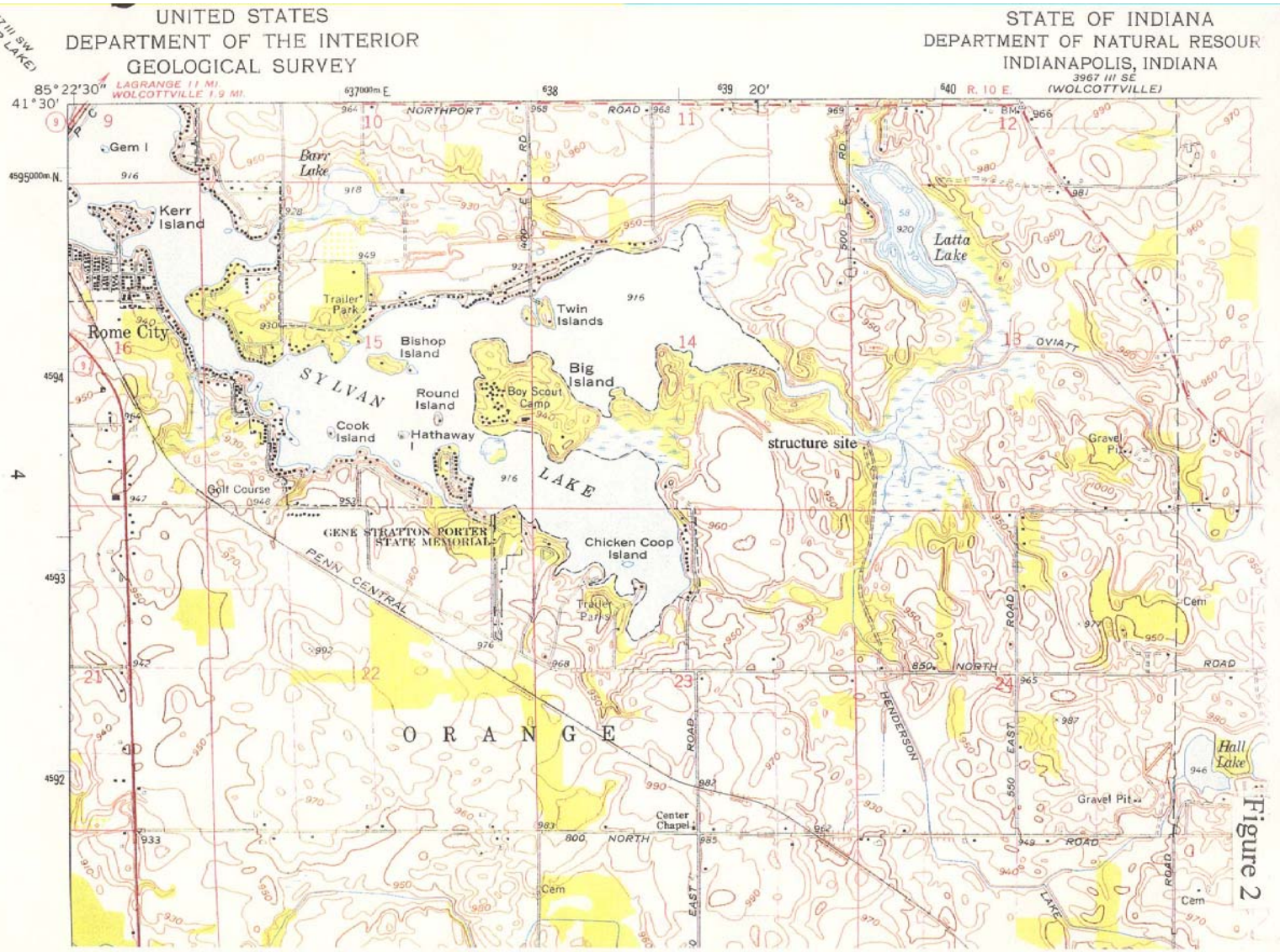
Progress on the development of the wetland enhancement was delayed by uncertainties resulting from the draining of Sylvan Lake and the rehabilitation of the Sylvan Lake Dam (also known as the Northport Feeder Dam). Now that the dam rehabilitation is complete, the next phase of improvements to Sylvan Lake is construction of the sediment control structure.

Evaluation of prospective sites for a sediment control structure

Several options for siting of a sediment control structure were considered during the course of project design. Determination of a recommended site was based on AGNPS modelling studies, site visits, discussions with the Noble County surveyor, and meetings with landowners and members of the Sylvan Lake Improvement Association. Factors including sediment trapping efficiency, conformity with existing land uses, acceptance by local property owners, and preservation of existing wetland values, have been considered in determining the recommended location and design of the sediment control structure.

Wetland sites considered during the course of the design study included the following:

- Immediately upstream of 850 North Road (see Figure 2). This site was ranked high by the AGNPS modeling. However, wetland development at this location would require clearing of trees, grading an access road and excavation and construction of a wetland extending beyond the channel of Henderson Lake Ditch. Construction costs of this design were substantially higher than were those of other sites. Some sediment is now deposited in the stream channel upstream of 850 North Road during low flow periods, however, this sediment is resuspended during storm events and transported downstream.


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF INDIANA
DEPARTMENT OF NATURAL RESOUR
INDIANAPOLIS, INDIANA
3967 III SE
(WOLCOTTVILLE)
85° 22'30"
41° 30'
LAGRANGE 11 MI.
WOLCOTTVILLE 1.9 MI.
637000m E.
638
639
20'
640
R. 10 E.
4595000m N.
4594
4593
4592
Gem I
Barr Lake
Kerr Island
Rome City
Trailer Park
Twin Islands
Bishop Island
Big Island
Round Island
Boy Scout Camp
Cook Island
Hathaway
SYLVAN LAKE
Golf Course
GENE STRATTON PORTER STATE MEMORIAL
Chicken Coop Island
PENN CENTRAL
ORANGE
NORTHPORT ROAD
Latta Lake
OVIATT
structure site
Gravel Pit
Cem
NORTH ROAD
HENDERSON
EAST
Hall Lake
Center Chapel
800 NORTH
550 EAST
LAKE ROAD
Cem
4
Figure 2

- Immediately upstream of 800 North Road (see Figure 2). Constructing a wetland at this location would require taking farmland out of production and submerging farm drains in the vicinity. Discussions with the County Surveyor indicated that this site was unlikely to be feasible because of interference with local drainage facilities. Landowner approval was also not considered to be likely.

- The upstream end of the existing Sylvan Lake wetland (see Figure 2). This site had advantages of accessibility, of posing little disruption to existing land uses, and of low cost. However, landowner permission was not obtained for installation of a structure at this location.

- The downstream end of the existing Sylvan Lake wetland (see Figure 2). Construction of a sediment control structure at this location, immediately upstream of the point where Henderson Lake Ditch discharges into Sylvan Lake, had advantages of accessibility, low cost, effective control of sediment and minimal disturbance to existing land uses. However, permit approval for this location was viewed as being the most problematic of all the sites under consideration.

As a result of these studies, the recommended site for the sediment control structure is at the downstream end of the Sylvan Lake wetland, the same location suggested in the feasibility report.

DESCRIPTION OF THE PROJECT

The Project consists of a low weir that would protect Sylvan Lake water quality by retaining sediment and sediment-bound nutrients transported by small and moderate-sized storms. Nutrients retained by the structure will be available for uptake by wetland vegetation. Storms producing significant amounts of runoff will pass over the weir while generating a negligible backwater effect.

The weir crest will project 1 foot above normal water level and will extend across the approximately 120-foot-wide narrows formed where an abandoned railroad line spanned

Henderson Creek Ditch. The abutments to the old (no longer existing) railroad bridge will also serve as abutments to the weir and the abandoned track bed will serve as an access road to the site. A trapezoidal notch in the weir will allow passage of low and normal flows in Henderson Ditch. Removal of vegetation along the footprint of the structure will be required for construction. Otherwise, disturbance of the wetland and channel during construction will be minimal.

The abutments on either side of the weir are sufficiently broad and stable to allow a backhoe to be driven up to the weir so that the structure can be maintained and accumulated sediment removed from behind the weir and the abutments. Rome City has agreed to assume the responsibility for removing silt deposited at the site and for disposal of this material.

Two options for construction of a sediment control structure were considered.

- Option A: construction of a broad-crested weir from gabions, earth or rockfill; and
- Option B: construction of a sharp-crested weir of sheetpile.

While Option A is considered to be more aesthetically pleasing, Option B is the preferred alternative because it has lower construction costs and fewer uncertainties associated with construction and operation.

Operation during low and normal flows

As noted above, the proposed weir is designed with a notch located along the axis of Henderson Lake Ditch. During periods of low flow, the notched-weir offers no obstruction to water passing into Gravel Pit Basin. By allowing wetland water levels to fluctuate below the normal water level, the notch aids in maintaining the hydrologic balance of the wetland and preserves passage for aquatic organisms between the wetland and Sylvan Lake. Because low flows typically carry little sediment or sediment-bound nutrients or chemicals, passage of low flows does not compromise the function of the weir as a water quality enhancement.

Operation during moderate runoff events

The primary purpose of the proposed weir is to provide a period of extended detention during moderate runoff events and during the first flush of larger events. By reducing the volume of water flowing into Gravel Pit Basin during these periods, runoff will be briefly retained in the marsh behind the weir producing sedimentation of fine soil particles. Nutrients adsorbed by these particles will then be consumed by wetland vegetation rather than passing through to Sylvan Lake.

Operation during major runoff events

During high flows the weir is designed to be completely submerged and to offer little obstruction to flood flows. Because of its low height the weir will have little effect on upstream water levels and on inundation caused by flood flows. Flow of bed load sediment during floods will be impeded by the submerged weir and its abutments. Therefore, it is likely that sediment will need to be removed from these locations periodically. Sediment deposition can be measured from a small boat by probing to determine the depth of soft sediment accumulated upstream of the structure. By probing sediment depths in a systematic grid pattern, the depths measured at each location can be mapped to determine the pattern of sediment deposition and the volume of material deposited.

Soft sediment can be removed from areas immediately adjacent to the weir abutments using an excavator or dragline. If necessary a small dredging machine such as a "Mudcat" can be used to remove sediment from areas behind the weir that are beyond the reach of excavators.

Figure 3 illustrates the influence on the project on wetland hydroperiods. Because of the notch allowing passage of low and moderate flows in Henderson Lake Ditch, the sediment control structure will have no impact on the area that is saturated (F) and permanently flooded (E). The structure will retard storm runoff increasing the duration of intermittent flooding (D). Flow over the weir crest and through the notch will permit sufficiently rapid drainage to cause little expansion of the area that is semipermanently flooded (C), no expansion of the area that is seasonally flooded (B), and minor expansion of the area that is temporarily flooded (A).

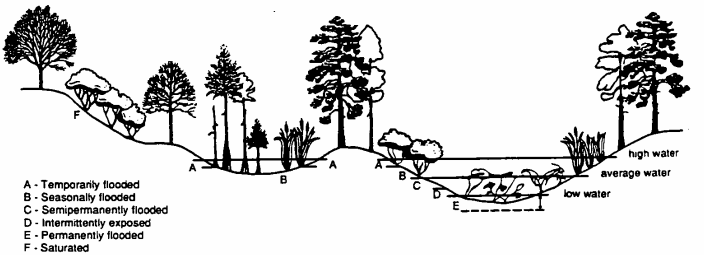


Figure 3. *Nontidal hydroperiods* (Source: Cowardin et al., 1979).

- *Temporarily Flooded.* Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface.

- *Seasonally Flooded.* Surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.

- *Semipermanently Flooded.* Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

- *Intermittently Exposed.* Surface water is present throughout the year except in years of extreme drought.

- *Saturated.* The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

HYDROLOGY AND HYDRAULICS

Flows at the site of the weir have been based on information taken from the Noble County Indiana Flood Insurance Study[1] and from the *Hydrologic Modeling of Sylvan and Waldron Lakes in Noble County, Indiana*[2]. Normal water level for Sylvan Lake is established at 916.2 feet mean sea level datum. This water level is reported to have been maintained after the recent rehabilitation of the Sylvan Lake dam.

The Flood Insurance Study reports flows and inundation depths at several locations along Henderson Lake Ditch. Cross section A taken for the flood insurance study lies very near the site of the proposed weir. At the time of the study, the bottom elevation of this section was 915.2 ft MSL; the section was 126 ft in width and had an area of 174 ft sq[2]. These dimensions are very similar to the those taken from the survey performed for this Project.

Peak flow characteristics at this location were reported as shown below:

	Flows Characteristics (24-hour storm)			
	10-year	50-year	100-year	500-year
Peak Discharge (cfs)	224.0	288.0	320.0	384.0
Water Surface Elevation	917.4	917.5	917.6	917.7
Flow Depth (ft)	2.2	2.3	2.4	2.5

Based on Indiana Department of Natural Resources guidelines, the 100-year 24-hour storm flow of 320 cfs was selected as the basis for design.

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[1]Flood Insurance Study, Noble County Indiana (unincorporated areas), Federal Insurance Administration, U.S. Dept. of Housing & Urban Development, 1978.

[2]Hydrologic Modeling of Sylvan and Waldron Lakes in Noble County, Indiana, Indiana Department of Natural Resources, Division of Water, 1993.

ENVIRONMENTAL ISSUES

The primary environmental consequence of the project will be to reduce sediment and associated agricultural chemical transport to Sylvan Lake.

Although wildlife surveys have not been performed in the vicinity of the proposed wetland enhancement, wildlife in the project area would be typical of rural Indiana, ranging from white-tailed deer to small rodents, herpetiles, and birds. No threatened or endangered species will be impacted. The net effect of the structure will be to prolong retention of water in the existing wetland after runoff events thereby expanding the area covered by wetland vegetation.

An environmental concern raised by construction of the weir is that Sylvan Lake, Latta Lake and Hall Lake are sources for carp which now swim from these lakes directly into the wetland without restriction. The new weir will restrict influx upstream into the wetland during moderate and major runoff events as the flow velocities will increase in the notch in moderate events and water will flow over the weir crest during high flow events. During normal and low flows, fish will be able to pass freely through the notch. Carp from Latta Lake and Hall Lake which are upstream of Sylvan Lake will continue to have unobstructed passage to the wetland. Fingerlings from these lakes now wash into the wetland during runoff events.

Carp control

At the request of the Indiana Department of Natural Resources, Harza investigated the possibility of incorporating methods to reduce the influx of carp into the wetland. The goal of this reduction would be to aid the proliferation of plants and to improve the water cleaning efficiency of the wetland. Descriptions of candidate techniques for controlling carp are presented below.

Fish combs

Fish combs have been used to restrict fish migration over weirs. One type of comb is made of fiberglass and extends beyond the weir at an angle. These combs can be used in conjunction with electrode pulse barriers to restrict fish migration. Fish combs would probably be successful in controlling migration of carp over a straight weir. However, they would be ineffective in

limiting migration through the notch especially during moderate or low flow periods in the summer. Because most fish would be expected to migrate through the notch, failure to control influx at this point makes the use of fish combs undesirable. In addition to ineffective control of carp, combs would be likely to bend under ice loads and to be clogged with floating debris.

Electrode pulse

Electrode fish barriers have been used effectively to exclude or control fish migrations at many locations. While likely to be effective in controlling carp influx to the wetland, installation of electrode pulse equipment would be expensive. A temporary facility at this site would cost in the order of $60,000 while a permanent facility would cost approximately $110,000. In addition to the cost of the fish barrier itself, the cost of running power from the nearest electric line could add $50,000 to either alternative. Typical operation costs for an electrode pulse fish barrier are about $600 per year.

Rotary screen drum

Rotary drum screens consist of a cylindrical screen that rotates so that floating debris lodged against the screen rides over the drum and is washed off downstream. Although maintenance costs for these screens are typically low, the installation cost of a rotary screen drum at the Sylvan Lake site is expected to approach $100,000.

Recommendations

Among the three options for carp control described above, it does not appear that there is a technique that is both effective and low in cost. For this reason, we recommend that the wetland enhancement facility be installed without a fish restriction. Much of the wetland vegetation consists of carp resistant plants (cattails, bulrushes, etc.). Therefore, while large numbers of carp may resuspend sediment, it is unlikely that carp will affect the health of the wetland.

A two-year evaluation period is recommended to determine whether installation of fish control measures would benefit the wetland and could be fabricated and installed at an acceptable cost. We suggest that monitoring of the site might best be carried out by staff of the U.S. Fish and

Wildlife Service or the Division of Wildlife, IDNR.

MAPPING AND SURVEYING

Mapping and surveying of the Sylvan Lake wetland was conducted at Sylvan Lake by Brown Consulting Engineers during March 1992. Mapping of the location of the sediment control structure is shown in Appendix A.

GEOTECHNICAL INVESTIGATIONS

To define the foundation characteristics of the proposed low weir structure, to characterize the accumulated sediment, and to establish design criteria, Harza conducted a subsurface exploration and laboratory testing program. The subsurface exploration program included six borings, four of which were drilled near the location of the proposed structure. The laboratory testing program included the following tests: Atterberg Limits, gradation analysis, and moisture content.

Subsurface soil exploration and laboratory testing of soil samples were conducted in accordance with standard practices. The results of the soil exploration and testing were used to determine criteria for construction of the sediment control structure.

This section presents, summarizes, and interprets subsurface and laboratory information that has been gathered as a result of drilling and testing of selected soil samples. Sampling and testing data are presented in Appendix B.

Field work

Field work was conducted on March 19, 1993. The subsurface exploration program is summarized below.

The borehole locations are shown on Exhibit 1 of Appendix B. Boreholes BH-1 and BH-2 were located at the north end of Siegrist Road near the left abutment of the proposed low weir structure. BH-1 was located about four feet from the water surface. BH-2 was located in the water three feet east of the extreme end of the road. Borehole BH-3 was also near the left

abutment of the proposed structure about 27 feet east of Siegrist Road. Borehole BH-6 was located near the right abutment at the base of the slope.

Samples were obtained at approximately one-foot intervals and were visually classified in the field. Some samples were placed into jars and retained for testing in Harza's soil laboratory.

Laboratory testing

Laboratory testing was conducted to determine the gradation of the sample, the characteristics of fine grained materials and organic content. Testing was conducted according to ASTM standards as follows:

Test	ASTM Designation
Particle-Size Analysis of Soils	D-422
Atterberg Limits	D-4318
Moisture Content	D-2216
Organic Matter Content	D-2974

Summary of field and laboratory results

Soil boring BH-1 was drilled at the north end of the road. The ground was covered with snow. Beneath the six inches of snow and ice was a layer of dark brown organic, sand, and clay topsoil. Beneath the topsoil was brown, coarse sandy clay with some fine gravel. The material appears to be fill material used to extend the road. The road continues on the other side of the creek. Large boulders have been placed at the end of the road on the south side of the creek.

Soil boring BH-2 was drilled in the water about three feet from the edge of the road. There was a six-inch layer of very soft organic muck. Beneath the upper muck layer was a sand, clay and an organic soil layer. At a depth of three feet beneath the surface of the water was a layer of sand and gravel.

Soil boring BH-3 was drilled in the water 15 feet north of the left creek bank about 27 feet east of the intersection of the road and the natural creek bank. The hole was drilled from the surface of the ice. A large log was located along the east edge of the ice sheet. The water in this area is calm because the main flow is in the center of the creek where the road encroaches upon the creek. The upper layer was very soft leaves and muck. Beneath the upper muck layer was a 15-inch-thick layer of very soft to soft organic material with some fine-grained sand and silt. The organics which make up 14.7 percent of the soil were fibrous, being, in part, decayed wood. At a depth of 3.25 feet beneath the water surface was a layer of very soft clay and decayed wood.

Well-graded yellow sand with fine to medium gravel was found at a depth of 7 feet beneath the water surface. The sand and gravel soil had a matrix of yellow silt. The matrix made up about 10 percent of the soil.

Soil boring BH-6 was drilled six feet from the slope toe across the creek from BH-3. The upper 18 inches were muck and organic soil. Beneath the organic soil was a layer of green clayey fine sand. At a depth of 3.8 feet, was a layer of yellow, fine gravely coarse sand. The grains were angular with a mixture of minerals represented. A dark green-brown layer of sand with silt and fine gravel was found at a depth of 4.75 feet. This layer continued to a depth of 6 feet. The gravel content increased at 6 feet.

Conclusions

The exploration program which was conducted at the Sylvan Lake wetland site and the laboratory testing of soil samples provided information regarding soil profiles needed for design of the sediment control structure. In addition, the sampling provided information on the characteristics of the existing retained sediment.

The foundation conditions at the borehole are well defined. Sand and gravel was found within 6 feet of the surface in all locations. The sand and gravel layer is sufficiently dense to provide resistance for driven piles.

PERMITTING STATUS

Permits necessary for construction of the sediment control structure have been approved. Copies of the following documents are contained in Appendix C:

- IDNR Certificate of Approval for Construction in a Floodway;
- Army Corps of Engineers Section 404 Permit;
- IDEM Section 401 Water Quality Certificate; and
- letter from the IDNR Division of Historic Preservation.

INSPECTION PLAN

Removal and off-site disposal of soft sediments

Measurement of the quantity of soft sediment removed from the site will be based on survey data. The inspector shall verify that the surveying procedure is accurate for computation of the quantity.

The inspector will verify that roadways are cleaned and maintained during construction as directed by the specifications.

Placement of sheetpile

Measurement of the quantity and type of sheetpile used will be verified by the inspector. The inspector will also verify by survey the level of the weir crest and the dimensions of the weir notch.

Restoration of shoreline to preconstruction condition

After completion of construction the inspector will verify that the shoreline and construction staging area have been restored to preconstruction condition. The inspector will be required to signify that the work is complete before the contractor will receive payment for this item.

OPERATION & MAINTENANCE/MONITORING PLAN

The weir spanning Henderson Lake Ditch is designed to trap sediment immediately behind the weir and its abutments.

The time required to deposit sufficient sediment behind the weir to limit its effectiveness is unknown. Therefore, the determination of the long-term maintenance cycle will be based on information gathered during the first five years of site monitoring.

During the first two years, the deposition of silt, the condition of the weir and its abutments, and changes in the extent or type of wetland vegetation should be inspected every six months by probing the depth of accumulated soft sediment by wading or from a boat.

Sediment should be removed from behind the weir and its abutments when the depth of sediment accumulated behind the weir is such that the sheetpile projects only four inches above the accumulated sediment.

After two years, if maintenance requirements prove to be minimal, then the frequency of inspection can be reduced to once every year. If maintenance requirements continue to be minimal after four years, then the inspection schedule can be further reduced to once every two years.

Inspection and maintenance report forms are included in Appendix D.

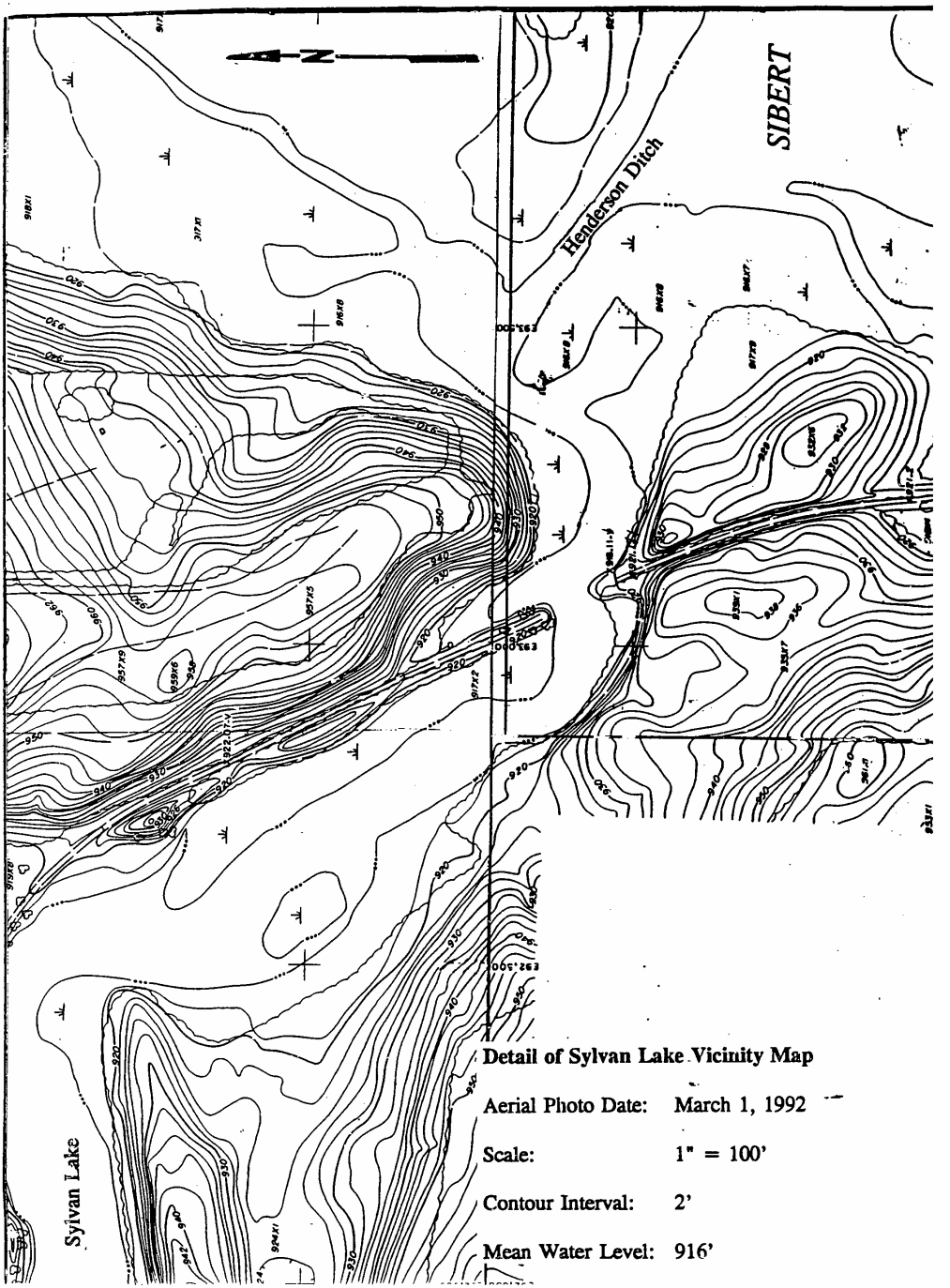
PROJECT DESIGN

Design details of the Sylvan Lake Sediment Control Structure are presented in Appendix E. This appendix includes design computations, drawings, and a cost estimate.

SUPPORTING DESIGN REPORT

APPENDICES

APPENDIX A - MAPPING



Detail of Sylvan Lake Vicinity Map

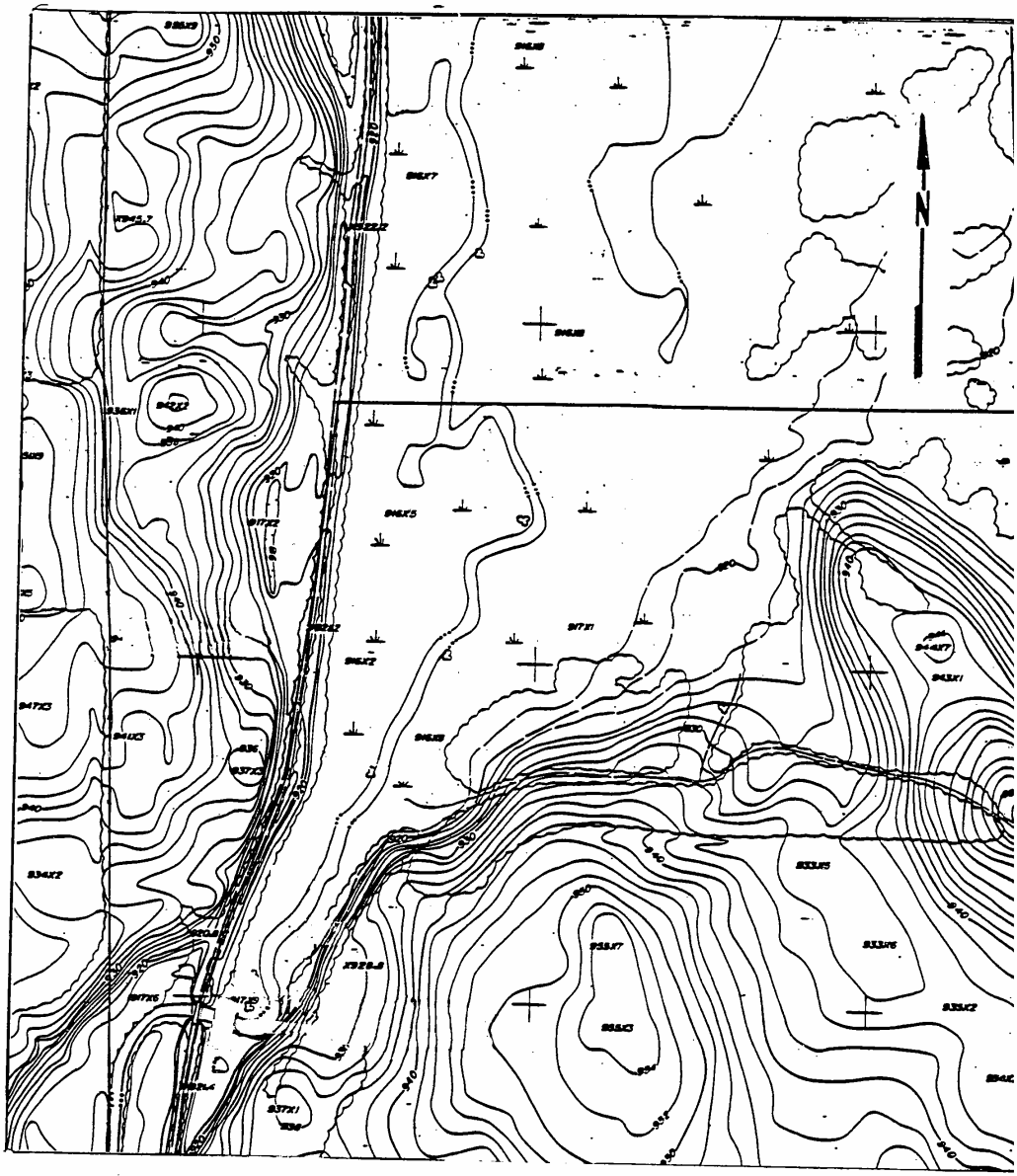
Aerial Photo Date: March 1, 1992

Scale: 1" = 100'

Contour Interval: 2'

Mean Water Level: 916'

Exhibit 1 – Sheet 2



APPENDIX B - GEOTECHNICAL DATA

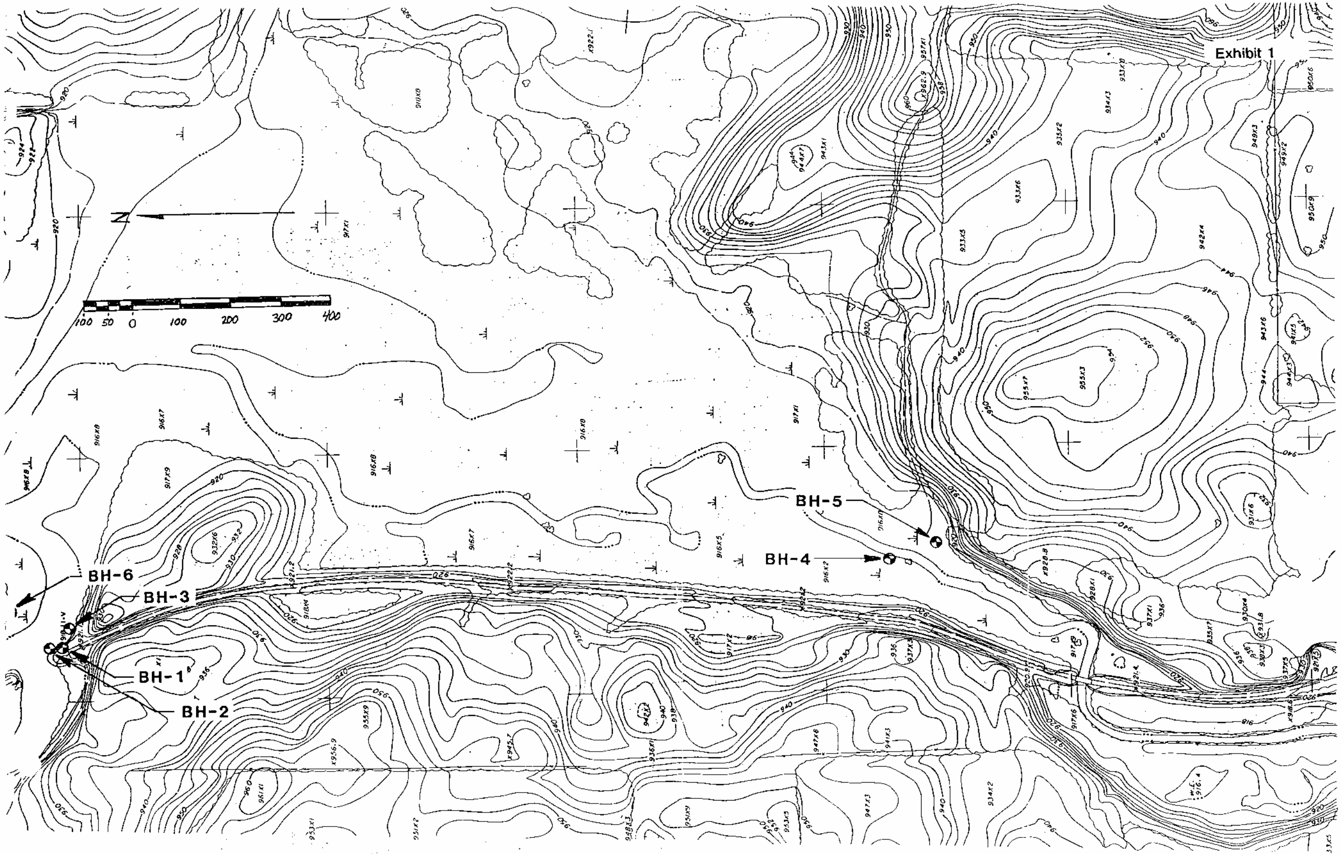


Exhibit 1
N
100 50 0 100 200 300 400
BH-5
BH-4
BH-6
BH-3
BH-1
BH-2

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

Project Number 5256B
Client SYLVAN LAKE
Contractor HARZA
Drilling Method HAND AUGER
Hole Size 3 INCH
Driller C.R O'DONNELL
Logged by C.M BROWN

Project Name SYLVAN LAKE

WATER LEVEL	2.6'		
TIME	-		
DATE	3/19		

Sample Hammer: Weight —
Drop —
Sampler Dimensions 3IN × 10 IN

Boring No. BH-1
Location ROAD AT MOUTH OF CREEK
Coordinates: N
E
Ground Elevation ~920 FT
Total Depth 2.6 FT
Date Started 3/19/93
Date Completed 3/19/93

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: SNOW	
0		1				8"			SNOW TOPSOIL, DK BROWN, ORGANIC, SANDY AND CLAY TOPSOIL	
1		2				8"			BROWN COARSE SANDY CLAY WITH SOME FINE GRAVEL	
2		3	JAR			8"				
		4				~11"				
3									EOB 2.6 ft	HIT GRAVELS AND TREE ROOT
4										

NOTE THAT GRAVEL FILL HAD BEEN PLACED TO CONSOLIDATE SOIL.

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

Project Number 5256B
Client SYLVAN LAKE
Contractor HARZA
Drilling Method HAND AUGER
Hole Size 3 IN
Driller CR O'DONNELL
Logged by CM BROWN

Project Name SYLVAN LAKE

WATER LEVEL	0'		
TIME			
DATE	3/19		

Sample Hammer: Weight
Drop
Sampler Dimensions 3" x 10"

Boring No. BH-2
Location IN WATER NE of ROAD
Coordinates: N
E
Ground Elevation 914 ft
Total Depth 3.5 ft
Date Started 3/18/93
Date Completed 3/19/93

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: WATER	
0									WATER	
1										
2		1	JAR						VERY SOFT ORGANIC MUCK	
		2							SAND CLAY AND ORGANIC SOIL	
3		3							SAND AND GRAVEL	
4									EOB 3.5 ft	
									HIT GRAVEL TOO COARSE TO SAMPLE	
									PROBABLY NEAR BACK MARSHALL.	

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

Project Number 5256B
Client SYLVAN LAKE
Contractor HARZA
Drilling Method HAND AUGER
Hole Size 3 IN
Driller C.R.J. DENNELL
Logged by CM BROWN

Project Name SYLVAN LAKE

WATER LEVEL	0 ft		
TIME	-		
DATE	3/19/93		

Sample Hammer: Weight -
Drop -
Sampler Dimensions 3" x 10"

Boring No. BH-3
Location 27 FT EAST of RD, 15 Ft NORTH OF BANK
Coordinates: N
E
Ground Elevation 914.75 FT
Total Depth 9.25 FT
Date Started 3/19/93
Date Completed 3/19/93

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: WATER	
0									▽ WATER	
1									VERY SOFT LEAVES AND MUCK	
2		1	JAR						VERY SOFT to SOFT WOOD, ORGANICS, DECAYED WOOD AND FIBROUS MATERIAL	14.7% ORGANIC CONTENT
3										
4		2	JAR						RED, VERY SOFT CLAY AND DECAYED WOOD. RED SILT	
5										
6		3								
7		4	JAR						WELL GRADED YELLOW SAND FINE TO MEDIUM GRAINED SAND. SOME YELLOW SILT	
8										
9									EOB 9¼ FT	

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

Project Number 5256B
Client SYLVAN LAKE
Contractor HARZA
Drilling Method HAND AUGER
Hole Size 3 IN
Driller CRB
Logged by CMB

Project Name SYLVAN LAKE

WATER LEVEL	3.5'		
TIME			
DATE	3/19		

Sample Hammer: Weight —
Drop —
Sampler Dimensions 3" X 10"

Boring No. BH-4
Location center of wetland left of creek
Coordinates: N
E
Ground Elevation 916 FT
Total Depth 7.25 FT
Date Started 3/19/93
Date Completed 3/19/93

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: SNOW 6" DEEP	
0		1	JAR						DARK BROWN ORGANIC, SILT SOIL WITH SOME HIGH PLASTICITY CLAY. SOFT TO FIRM	7.4 % ORGANIC
1		2								
2		3							OCCASIONAL ROOTS	
3		4	JAR						▽ - - -	
4		5							BLACK ORGANIC SILT VERY SOFT. NOT FIBROUS	
5		6							BLACK CLAY	
6		7	JAR						DARK BROWN FINE TO COARSE SAND, SOME SILT AND FINE TO MEDIUM GRAVEL; GTZ & SAND WITH BLACK SAND & STR. FRAG.	
7		8							GRAVEL WITH SILTY SAND	
		9							LOG 7.25 ft	
8										

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

Project Number 5256B
Client SYLVAN LAKE
Contractor HARZA
Drilling Method HAND AUGER
Hole Size 3"
Driller CRU
Logged by CMB

Project Name SYLVAN LAKE

WATER LEVEL	2.75		
TIME			
DATE	3/19		

Sample Hammer: Weight
Drop
Sampler Dimensions 3"x10"

Boring No. BH-5
Location ET SIDE OF CREEK NEAR HILL
Coordinates: N
E
Ground Elevation 916.54
Total Depth 6.5 ft
Date Started 3/19
Date Completed 3/19/93

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: SNOW 6 INCHES DEEP	
0		1							FROZEN GROUND, GRASS, REEDS	
1		2							DARK BROWN ORGANIC, SILT SOIL WITH SOME CLAY.	
		3								
2		4								
									▽	
3		5								
4		6								
5		7								
		8								
6		9							DARK BROWN SILT WITH COARSE SAND AND FINE GRAVEL	
		10								
7									EOB 6.5 ft	
									GRAVEL CONTENT INCREASING	
8										
9										

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

Project Number 5256B
Client SYLVAN LAKE
Contractor HARZA
Drilling Method HAND AUGER
Hole Size 3IN
Driller CRO
Logged by CMF

Project Name SYLVAN LAKE

WATER LEVEL			
TIME			
DATE			

Sample Hammer: Weight
Drop
Sampler Dimensions 3" x 10"

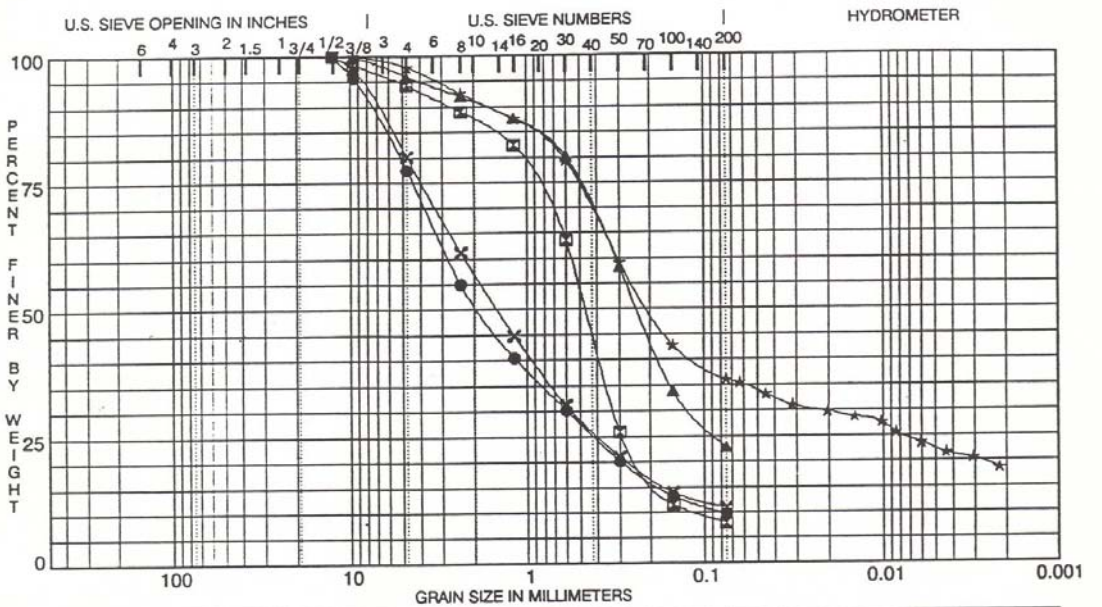
Boring No. BH-6
Location PROPOSED RT ABUTMENT
Coordinates: N
E
Ground Elevation 917 FT
Total Depth 6 FT
Date Started 3/19/93
Date Completed 3/19/93

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: MARSH VEGETATION + WATER	
0		1							LEAVES AND BLACK ORGANIC VERY SOFT MUCK	
1		2	JAR						DARK GRAY SILTY SAND W/ ORGANICS	
2		3	JAR						GREEN CLAYEY FINE SAND	
3		4								
		5								
		6								
4		7							YELLOW FINE GRAINED POORLY GRADED SAND, MIXTURE DK + LT ANGULAR GRAINS.	
5		8	JAR						DARK GREEN BROWN, SAND WITH SILT AND FINE GRAVEL	
		9								
6									EOB 6 FT	
7										

Sheet No. _____
Date 2.4.93

HARZA

Project Name SYLVAN LAKE Project Number 5256B



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	BH-3 S-4	7.0	WELL GRADED SAND with SILT and GRAVEL SW-SM	6	NP	NP	NP	1.59	34.7
■	BH-4 S-7	6.0	POORLY GRADED SAND with SILT SP-SM	26	NP	NP	NP	1.67	5.1
▲	BH-6 S-2	1.0	SILTY SAND SM	22	NP	NP	NP		
★	BH-6 S-4	2.5	CLAYEY SAND SC	16	28	16	12		
✕	BH-6 S-8	4.8	WELL GRADED SAND with SILT and GRAVEL SW-SM	7	NP	NP	NP	1.97	32.0

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH-3 S-4	7.0	12.50	2.77	0.592	0.0796	22.6	67.7	9.7	
■	BH-4 S-7	6.0	12.50	0.56	0.324	0.1114	5.8	86.2	8.0	
▲	BH-6 S-2	1.0	12.50	0.32	0.118		4.1	73.1	22.8	
★	BH-6 S-4	2.5	9.50	0.31	0.022		2.2	61.7	13.7	22.4
✕	BH-6 S-8	4.8	12.50	2.24	0.556		19.9	69.1	11.0	

Organic Content, %

BH-3	S-1	2.0'	14.7
BH-4	S-1	0.0'	7.4

APPENDIX C - PERMIT APPROVALS

MAILED

JUN 17 1996

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

CERTIFICATE OF APPROVAL
CONSTRUCTION IN A FLOODWAY

APPLICATION #: FW-16,888

STREAM : Henderson Ditch

APPLICANT : Sylvan Lake Improvement Association
P.O. Box 696
Rome City IN 46784

AGENT : Harza Engineering Company
233 South Wacker Drive
Chicago IL 60606-6392

AUTHORITY : IC 14-28-1 with 310 IAC 6-1

DESCRIPTION : A 170' long gabion weir will be constructed across a narrow section of Henderson Ditch where it enters the upper end of Sylvan Lake in the area known locally as the Gravel Pit Basin for the purpose of enhancing the sediment trapping capabilities of the existing wetland located immediately upstream of the site. The gabion weir will have a maximum crest elevation of 917', NGVD which is 1' above the normal level of Sylvan Lake. Low flows will be maintained by a trapezoidal shaped notch in the weir having a crest elevation of 910.0', NGVD, top width of 54', bottom width of 15', and approximately 3:1 side slopes. A forebay (sediment trap) will be excavated in Henderson Ditch at the inlet to the wetlands. Sediment will be removed from the gabion structure and forebay on an as needed basis to insure the proper operation of these structures. Details of the project are contained in plans and information received at the Division of Water on June 2, 1995 August 18, 1995, October 13, 1996 and April 10, 1996.

LOCATION : The gabion weir will be located across Henderson Ditch at the north end of the unnamed access road approximately 500' downstream (west) of the confluence with Oviatt Ditch; the forebay (sediment trap) will be located on the upstream (west) side of the unnamed access road where it crosses Henderson Ditch approximately 2,200' downstream (north) of where the ditch crosses under C.R. 850 North at Rome City, Orange Township, Noble County
NW¼, SW¼, SW¼, Section 13, T 35N, R 10E, Kendallville Quadrangle
UTM Coordinates: Downstream = 4593725 North, 639675 East, Upstream = 4593050 North, 639675 East

APPROVED BY : John N. Simpson

John N. Simpson, PE
Director
Division of Water

APPROVED ON : June 14, 1996

Attachments: Notice Of Right To Administrative Review
Special Conditions
General Conditions
Service List

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

NOTICE OF RIGHT TO ADMINISTRATIVE REVIEW

APPLICATION #: FW-16,888

This signed document constitutes the issuance of a permit by the Natural Resources Commission, or its designee, subject to the conditions and limitations stated on the pages entitled "General Conditions" and "Special Conditions".

The permit or any of the conditions or limitations which it contains may be appealed by applying for administrative review. Such review is governed by the Administrative Orders and Procedures Act, IC 4-21.5, and the Department's rules pertaining to adjudicative proceedings, 310 IAC 0.6.

In order to obtain a review, a written petition must be filed with the Division of Hearings within 18 days of the mailing date of this notice. The petition should be addressed to:

Mr. Stephen L. Lucas, Director
Division of Hearings
Room W272
402 West Washington Street
Indianapolis, Indiana 46204

The petition must contain specific reasons for the appeal and indicate the portion or portions of the permit to which the appeal pertains.

If an appeal is filed, the final agency determination will be made by the Natural Resources Commission following a legal proceeding conducted before an Administrative Law Judge. The Department of Natural Resources will be represented by legal counsel.

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

GENERAL CONDITIONS

APPLICATION #: FW-16,888

(1) If any archaeological artifacts or human remains are uncovered during construction, federal law and regulations (16 USC 470, et seq.; 36 CFR 800.11, et al) and State law (IC 14-21-1) require that work must stop and that the discovery must be reported to the Division of Historic Preservation and Archaeology within 2 business days.

Division of Historic Preservation and Archaeology
Room W274
402 West Washington Street
Indianapolis, Indiana 46204

Telephone: (317) 232-1646, FAX: (317) 232-8036

(2) This permit must be posted and maintained at the project site until the project is completed.

(3) This permit does not relieve the permittee of the responsibility for obtaining additional permits, approvals, easements, etc. as required by other federal, state, or local regulatory agencies. These agencies include, but are not limited to:

Agency	Telephone Number
Detroit District, U.S. Army Corps of Engineers	(313) 226-2218
Indiana Department of Environmental Management	(317) 243-5035
St. Joseph River Basin Commission	(219) 287-1829
Noble County Drainage Board	(219) 636-2131
Local city or county planning or zoning commission	Check local directory

(4) This permit must not be construed as a waiver of any local ordinance or other state or federal law.

(5) This permit does not relieve the permittee of any liability for the effects which the project may have upon the safety of the life or property of others.

(6) This permit may be revoked by the Department of Natural Resources for violation of any condition, limitation, or applicable statute or rule.

(7) This permit shall not be assignable or transferable without the prior written approval of the Department of Natural Resources. To initiate a transfer contact:

Mr. John N. Simpson, PE, Director
Division of Water
Room W264
402 West Washington Street
Indianapolis, Indiana 46204

Telephone: (317) 232-4160, FAX: (317) 233-4579

(8) The Department of Natural Resources shall have the right to enter upon the site of the permitted activity for the purpose of inspecting the authorized work.

(9) The receipt and acceptance of this permit by the applicant or authorized agent shall be considered as acceptance of the conditions and limitations stated on the pages entitled "General Conditions" and "Special Conditions".

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

SPECIAL CONDITIONS

APPLICATION #: FW-16,888

PERMIT VALIDITY: This permit is valid for 24 months from the "Approved On" date shown on the first page. If work has not been initiated by June 14, 1998 the permit will become void and a new permit will be required in order to continue work on the project.

CONFORMANCE : Other than those measures necessary to satisfy the "General Conditions" and "Special Conditions", the project must conform to the information received by the Department of Natural Resources on: June 2, 1995, August 18, 1995, October 13, 1995 and April 10, 1996. Any deviation from the information must receive the prior written approval of the Department.

Number	Special Condition
(1)	appropriately designed measures for controlling erosion and sediment must be implemented to prevent sediment from entering the stream or leaving the construction site; maintain these measures until construction is complete and all disturbed areas are stabilized
(2)	do not leave felled trees, brush, or other debris in the floodway
(3)	remove all construction debris from the floodway upon completion of the project
(4)	backfill all bore pits to the existing ground elevations

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

SERVICE LIST

APPLICATION #: FW-16,888

Sylvan Lake Improvement Association
P.O. Box 696
Rome City IN 46784

Harza Engineering Company
233 South Wacker Drive
Chicago IL 60606-6392

Regulatory Functions Branch
Detroit District, USACOE
c/o Mr. Gary Mannesto
P.O. Box 1027
Detroit MI 48231-1027

St. Joseph River Basin Commission
c/o John McNamara
1120 County City Building
South Bend IN 46601

Noble County Drainage Board
Attn: County Surveyor
2090 N. State Road9, Suite-B
Albion IN 46701

Noble County
Soil and Water Conservation Distric
100 East Park Drive
Albion IN 46701-1478

Division of Law Enforcement, IDNR
North Region Headquarters (Dist 2)
c/o Capt. Steven Seemeyer
RR 6, Box 344
Peru IN 46970

Rome City Plan Commission
Town Hall
Box 338
Rome City IN 46784

Noble County Plan Commission
2090 North State Road 9, #A
Albion IN 46701

Staff Assignment
Administrative: Anita R. Nance
Technical : Surender Sayini
Environmental : Stephen H. Jose

DEPARTMENT OF THE ARMY
DETROIT DISTRICT, CORPS OF ENGINEERS
BOX 1027
DETROIT, MICHIGAN 48231-1027

January 24, 1996

IN REPLY REFER TO

Construction-Operations Division
Regulatory Functions Branch
File No. 91-157-007-1A

Sylvan Lake Association
ATTN: Joseph C. Costello, President
P.O. Box 696
Rome City, Indiana 46784

Dear Mr. Costello:

We are enclosing two (2) copies of the draft Department of the Army permit for your signature. Your special attention is invited to the Special Conditions. PLEASE READ THESE AND ALL OTHER PERMIT CONDITIONS CAREFULLY BEFORE SIGNING. Your signature constitutes your specific agreement of all terms and conditions of the permit. Please note that disposal areas for dredged material shall be upland and non-wetland sites. Please be advised that certain abandoned gravel pits in the vicinity of Rome City may contain wetlands or other waters of the United States. Any discharge in these waters would require a permit from this office.

Please return both of your signed copies to our office. Upon receipt, the District Engineer or his designee is authorized to issue the permit on behalf of the Secretary of the Army by countersigning the draft permit. If issued, we will return one of the countersigned copies to you.

If the enclosed copies are not signed and returned within 30 days, we will suspend your application. Should you have any questions, please contact Thomas E. Allenson, Project Manager, at the above address or telephone (313) 226-2222. Please refer to File Number: 91-157-007-1A.

Sincerely,

"ORIGINAL SIGNED BY"
John Konik
Chief, Processing Section A
Regulatory Functions Branch

Enclosures

copy furnished:

David Miller, Harza Engineering w/encl. ✓

DEPARTMENT OF THE ARMY PERMIT

Permittee Sylvan Lake Association

Permit No. 91-157-007-1

Issuing Office U.S. Army Engineer District, Detroit

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:

discharge fill associated with the excavation of 635 yards of clay and muck material (with disposal in off-site, upland locations); discharge gabion blocks in a 2164 square foot (0.05 acre) wetland area to form a low level weir; discharge fill associated with excavation of a sediment trap from the upstream face of the proposed weir in a 100 by 40 by 10 foot deep wetland area (0.09 acre; 900 cubic yards of dredged material per year); construct and maintain two 40 foot by 40 (0.02 acre) foot by 10 deep sediment basins in wetlands within the "forebay" at the mouth of Henderson Ditch (800 cubic yards of dredged material per year). Maintenance dredging is proposed for a ten year period. The purpose of the work is to trap and remove nutrient bearing sediments entering the upstream wetlands of Sylvan Lake via Henderson Ditch to improve water quality in Sylvan Lake.

Project Location:

in wetlands adjacent to and in Sylvan Lake, offshore property in Section 13, T35N, R10, Kendallville, Indiana, Located one mile south of the intersection of Northport Road and County Road 500 E

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on 31 December 2006. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

1. Your signature, as permittee, indicates that, as consideration for the issuance of this permit, you voluntarily accept and agree to comply with all of the terms and conditions of this permit.

2. This permit does not authorize the discharges of dredged or fill material, including preliminary grading or incidental movement of soils, for access or haul roads, or to construct storing or staging areas or pads. Any temporary or permanent discharges of dredged or fill material into wetlands or other waters of the United States, other than that shown on the attached plans, shall not be commenced without prior written specific authorization from this office.

3. All dredged and/or excavated materials shall be disposed of at an upland location with no placement in, or return to, any waterway or wetland. **The Corps shall be consulted prior to any placement in abandoned gravel pits which contain impounded water.**

4. The permittee shall adhere to the conditions specified by the Indiana Department of Environmental Management (as attached) for waiver of Section 401 Water Quality Certification.

Further Information:

1. Congressional Authorities: You have been so authorized to undertake the activity described above pursuant to:

( ) Section 10 of the Rivers and Harbors Act of 1889 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modifications, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance of the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE) *(DATE)*

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

(DISTRICT ENGINEER) *(DATE)*
Randolph O. Buck
Colonel, U.S. Army

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE) *(DATE)*

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We make Indiana a cleaner, healthier place to live

Evan Bayh
Governor
Kathy Prosser
Commissioner

100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015
Telephone 317-232-8603
Environmental Helpline 1-800-451-602

November 17, 1995

VIA CERTIFIED MAIL Z 339 939 757

CERTIFIED
Z 339 939 757
MAIL

Mr. John Konik
U.S. Army Corps of Engineers
Attn: Thomas E. Allenson
P.O. Box 1027
Detroit, Michigan 48231

Dear Mr. Konik:

Re: Section 401 Water Quality Certification
Applicant: Sylvan Lake Association
Project: Wetland Enhancement
Public Notice No: 91-157-007-1A

Office of Water Management staff have reviewed Public Notice Number 91-157-007-1A dated October 11, 1995, for Section 401 Water Quality Certification. The applicant proposes to construct a low, weir dam and sediment traps for the enhancement of wetlands adjacent to and in Sylvan Lake. In order to facilitate the construction, the applicant proposes to fill a total of 0.16 acres of wetlands adjacent to Sylvan Lake. Maintenance dredging of the sediment trap is proposed for a ten year period and would be accomplished 2 to 3 times per year by backhoe.

Based on the site investigation and available information, it is the judgment of this office that the proposed project will likely improve the water quality of Sylvan Lake provided that conditions set forth by the State are incorporated into the project. Therefore, subject to the following conditions, the Indiana Department of Environmental Management (IDEM) hereby grants Section 401 Water Quality Certification:

1. The project engineer at the construction site will ensure that construction limits shown in the plans attached to Public Notice Number 91-157-007-1A will be clearly marked at all times during construction.

2. The project engineer at the construction site will ensure that all erosion control structures and devices will be regularly monitored and maintained, especially after rain events, until all soils disturbed by construction activities have been permanently stabilized.

REG FORCTS BR

NOV 95 8:1

3. Physical disturbance of banks, submerged vegetation and riparian vegetation, especially large trees which provide shade to Sylvan Lake, should be limited to that which is absolutely necessary to the conduct of the project.

4. The contractor performing the actual operations must comply with Section 311 of the Federal Clean Water Act and with 327 IAC 2-6 (formerly Indiana Stream Pollution Control Board Regulation 330 IAC 1-6-1) concerning spills of oil and hazardous materials.

5. Deposition of dredged or excavated materials and all earthwork operations will be carried out in such a manner that soil erosion and sediment runoff to any nearby watercourse are controlled and minimized. The use of straw bale barriers, silt fencing, or an earthen berm around disturbed areas is recommended to prevent soil from leaving the construction site. Information and assistance regarding control of construction-related soil erosion are available from the Soil and Water Conservation District offices, collocated with the local field office of the U.S. Department of Agriculture's Natural Resources Conservation Service in each county, and the regional field offices of the Indiana Department of Natural Resources' Division of Soil Conservation, whose administrative office is at 402 W. Washington Street, Room W264, Indianapolis, IN 46204. Areas used for deposition of dredged materials should be provided with temporary dikes or bulkheads for separation and retention of solids. Vegetative cover should be established on dredged or excavated material as soon as possible.

6. Contact the Recommendation Section of the Indiana Department of Natural Resources at 317/232-4164 regarding the possible requirement of a permit from the Indiana Department of Natural Resources.

7. The dredged material from the maintenance dredging will not be deposited in wetlands.

This certification is effective 18 days from the mailing of this notice unless a petition for review and a petition for stay of effectiveness are filed within this 18 day period. If a petition for review and a petition for stay of effectiveness are filed within this period, any part of the permit within the scope of the petition for stay is stayed for 15 days, unless or until an Environmental Law Judge further stays the permit in whole or in part.

This decision may be appealed in accordance with IC 4-21.5, the Administrative Orders and Procedures Act. The steps that must be followed to qualify for review are:

1. You must petition for review in a writing that states facts demonstrating that you are either the person to whom this decision is directed, a person who is aggrieved or adversely affected by the decision, or a person entitled to review under any law.

2. You must file the petition for review with the Office of Environmental Adjudication (OEA) at the following address:

   Office of Environmental Adjudication
   ISTA Building
   150 West Market Street
   Suite 618
   Indianapolis, IN 46204

3. You must file the petition within eighteen (18) days of the mailing date of this decision. If the eighteenth day falls on a Saturday, Sunday, legal holiday, or other day that the OEA offices are closed during regular business hours,you may file the petition the next day that the OEA offices are open during regular business hours. The petition is deemed filed on the earliest of the following dates: the date it is personally delivered to the OEA; the date that the envelope containing the petition is postmarked if it is mailed by United States mail; or, the date it is shown to have been deposited with a private carrier on the private carrier's receipt, if sent by private carrier.

Identifying the permit, decision, or other order for which you seek review by permit number, name of the applicant, location, or date of this notice will expedite review of the petition.

Note that if a petition for review is granted pursuant to IC 4-21.5-3-7, the petitioner will, and any other person may, obtain notice of any prehearing conferences, preliminary hearings, hearings, stays, and any orders disposing of the proceedings by requesting copies of such notices from the OEA.

Granting of Section 401 Water Quality Certification does not relieve the applicant from the responsibility of obtaining any other permits or authorizations that may be required for this project or related activities from the IDEM or any other agency or person.

If you have any questions regarding this decision, contact Mr. Brett Crump, Project Manager, of my staff at 317/243-5027, or you can reach the Office of Water Management through the IDEM Environmental Helpline (1-800-451-6027).

If you have procedural questions regarding filing a petition for review you may contact the OEA at 317-232-8591.

Sincerely,

R.J. Henley
Assistant Commissioner
Office of Water Management

cc: Sylvan Lake Association
Mr. Joseph C. Costello, President
Rome City, IN 46784

Dave Hudak
U.S. Fish & Wildlife

Steve Jose
Indiana Department of Natural Resources

INDIANA DEPARTMENT OF NATURAL RESOURCES

PATRICK R. RALSTON, DIRECTOR

Division of Historic Preservation
and Archaeology
402 W. Washington St., Rm. 274
Indianapolis, Indiana 46204
317-232-1646

October 25, 1993

David Pott
Harza Engineering Company
233 South Wacker Drive
Chicago, Illinois 60606-6392

Dear Mr. Pott:

We have reviewed the proposed wetland restoration T-2000 project (DNR #4989) at Sylvan Lake near Rome City in Noble County, Indiana.

No known historical, architectural, or archaeological sites listed on or eligible for inclusion in the National Register of Historic Places will be affected by this project.

If any archaeological artifacts are uncovered during construction, federal law and regulations (16 USC 470, et seq.; 36 CFR 800.11, et al.) and, additionally, state law (Indiana Code 14-3-3.4), require that work must stop and that the discovery must be reported to the Division of Historic Preservation and Archaeology within two (2) business days.

We appreciate the opportunity to be of service.

Very truly yours,

Patrick R. Ralston
State Historic Preservation Officer

PRR:SBG:vk

cc: Steve Jose, F&W

"EQUAL OPPORTUNITY EMPLOYER"

APPENDIX D - INSPECTION AND MAINTENANCE FORMS

SYLVAN LAKE SEDIMENT CONTROL STRUCTURE
INSPECTION AND MAINTENANCE
REPORT FORM

TO BE COMPLETED EVERY SPRING AND FALL

INSPECTOR:_____ DATE: _____ LAKE ELEV.:_____
PREVIOUS INSPECTION DATE:_____ CONCLUSIONS: _____
_____
_____
_____

WEIR AND ABUTMENTS

CONDITION OF CREST	CONDITION OF ABUTMENTS	EVIDENCE OF PROBLEMS

OTHER OBSERVATIONS:_____
_____

MAINTENANCE REQUIRED FOR WEIR AND ABUTMENTS:_____
_____
TO BE PERFORMED BY:_____ ON OR BEFORE:_____
COMPLETED BY:_____ DATE:_____
COMMENTS: _____

SYLVAN LAKE SEDIMENT CONTROL STRUCTURE
INSPECTION AND MAINTENANCE
REPORT FORM

AREA UPSTREAM OF WEIR AND ABUTMENTS

SEDIMENT ACCUMULATION					GENERAL REMARKS
INSPECTION POINTS		CONSISTENCY OF SEDIMENT	DEPTH TO FIRM SEDIMENT	ELEVATION OF FIRM SEDIMENT	
NO.	LOCATION				

OTHER OBSERVATIONS:_____

_____

_____

TO BE PERFORMED BY:_____ ON OR BEFORE:_____

COMPLETED BY:_____ DATE:_____

COMMENTS: _____

SYLVAN LAKE SEDIMENT CONTROL STRUCTURE
INSPECTION AND MAINTENANCE
REPORT FORM

WETLAND VEGETATION

CONDITION OF VEGETATION		
WETLAND SHORELINE	WETLAND CENTER	WEIR ABUTMENTS

OTHER OBSERVATIONS:_____

_____

MAINTENANCE REQUIRED FOR WETLAND VEGETATION:_____

_____

TO BE PERFORMED BY:_____ ON OR BEFORE:_____

COMPLETED BY:_____ DATE:_____

COMMENTS: _____

OTHER FEATURES

OBSERVATIONS:_____

_____

MAINTENANCE REQUIRED FOR: _____

_____

_____

TO BE PERFORMED BY: _____ ON OR BEFORE:_____

COMPLETED BY: _____ DATE: _____

COMMENTS:

_____

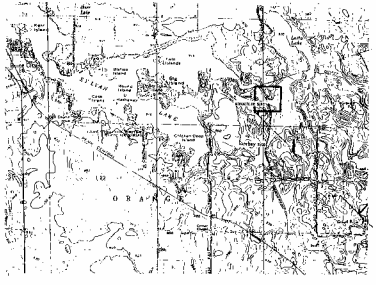
APPENDIX E - DESIGN INFORMATION

CONSTRUCTION PLANS FOR

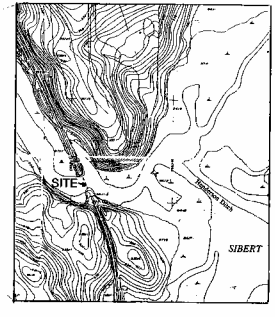
SYLVAN LAKE
ENHANCEMENT PROJECT

Rome City, Indiana
September 1997

DRAWING INDEX



SITE VICINITY MAP
NOT TO SCALE



PROJECT SPECIFIC NOTES

1. THE STEEL SHEET PILE SHALL BE PMA 22 (USS) ASTM A328 CARBON GRADE OR EQUAL. SEE TYPICAL SECTION ON SHEET 3.
2. THE ALIGNMENT OF THE CONTROL STRUCTURE IS APPROXIMATELY THE CENTER LINE OF SIEGRIST ROAD. THE FINAL ALIGNMENT SHALL BE ADJUSTED TO AN ALIGNMENT THAT WILL PROVIDE THE MOST SUITABLE FOUNDATION FOR THE STRUCTURE AND ACCEPTABLE FLOW CONDITION. FINAL ALIGNMENT IS SUBJECT TO THE APPROVAL OF SYLVAN LAKE IMPROVEMENT ASSOCIATION.
3. THE MINIMUM EMBEDMENT LENGTH SHALL BE 8 FEET FROM THE TOP OF DENSE SOIL OR GRAVEL. THE DESIGN ASSUMES EL. 910.
4. THE FINAL ALIGNMENT OF THE STRUCTURE SHALL BE ADJUSTED TO MINIMIZE INTERFERENCE FROM BURIED DEBRIS WHICH MAY IMPEDE DRIVING OF SHEETPILE.

MARK	BY	DATE	REVISIONS
0			
1			
2			
3			
4			

WARNING
IF THIS BAR IS NOT 1/2" WIDE AT ORIGINAL SCALE, THEN DRAWING IS NOT TO SCALE

Date: 9/8/97
Designed: J.R.
Drawn: J.S.
Checked: D.M.
DWG. File:

HARZA
Consulting Engineers and Scientists
620 Roland Way
Oakland, California 94621
TEL: (510) 569-6300
FAX: (510) 569-2269

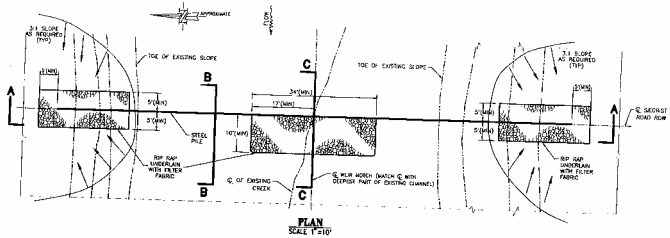
SYLVAN LAKE IMPROVEMENT ASSOCIATION
P.O.Box 637
Rome City, Indiana 46784

COVER / GENERAL NOTES

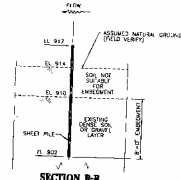
SYLVAN LAKE ENHANCEMENT PROJECT
Rome City, Indiana

SHEET 1 OF 2

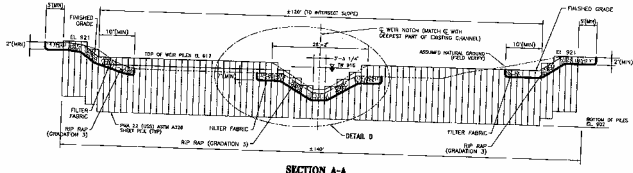
PROJECT NO. 0226-B



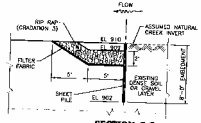
PLAN
SCALE 1"=10'



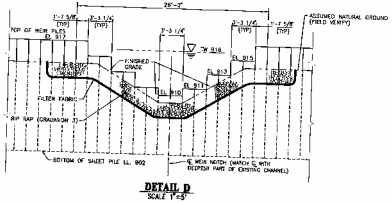
SECTION B-B
SCALE 1"=5'



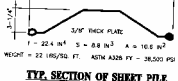
SECTION A-A
SCALE 1"=10'



SECTION C-C
SCALE 1"=5'



DETAIL D
SCALE 1"=5'



TYP. SECTION OF SHEET PILE
NOT TO SCALE

MARK	BY	DATE	REVISIONS
A			
A			
A			
A			
A			

WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

Date: 9/19/02
Designed: J.B.
Drawn: J.B.
Checked: R.M.
DWG File:

HARZA
Consulting Engineers and Scientists
400 Rouse Blvd
Oakland, California 94621
Phone (510) 562-2255
Fax (510) 562-2256

SYLVAN LAKE IMPROVEMENT ASSOCIATION
P.O.Box 627
Rome City, Indiana 46784

SEDIMENT CONTROL STRUCTURE

SYLVAN LAKE ENHANCEMENT PROJECT
Rome City, Indiana

SHEET 2 OF 2
PROJECT No. 5256-B

Sylvan Lake Wetland Enhancement Project - Supporting Design Report

Cost Estimate

Item No.	Description	Quantity	Unit	Unit Price	Cost
1	Mobilization/ demobilization		L.S.		$10,000.00
2	Steel sheet pile	2000	sq.ft.	$29.00	$58,000.00
3	Overburden excavation	100	cu. yd.	$10.00	$1,000.00
4	Soft sediment removal	60	cu. yd.	$18.00	$1,080.00
5	Riprap	45	cu. yd.	$15.00	$675.00
6	Filter fabric	70	sq. yd.	$5.00	$350.00
7	Surveying		L.S.		$2,500.00
8	Care of water		L.S.		$2,500.00
9	Site restoration		L.S.		$3,000.00
	Subtotal				$79,105.00
	15% Contingency				$11,865.75
	Total Construction Contract				$90,970.75
	8% Administration				$7,277.66
	Total cost				$98,248.41

Hydraulic Design of Sylvan Lake Spillway

lb ≡ 1M sec ≡ 1T ft ≡ 12·in ORIGIN := 1

$psi \equiv \frac{lb}{in^2}$ ksi ≡ 1000·psi $g \equiv 32.2 \cdot \frac{ft}{sec^2}$ kips := 1000·lb

Case 1: When the weir is filled with sediments and functioning as a channel.

Discharge of the Trapezoidal Channel- Design flood for sizing is 10-year flood 224 cfs

H := 1.03·ft B := 26.167·ft b := 3.17·ft L := 120·ft

n := 0.029 S := 0.0001 h := 7·ft $s_{ex} := 1.5$ excav. slope

$A_1 := B \cdot H + 0.5 \cdot (b + B) \cdot h$ $A_1 = 129.632 \cdot ft^2$

$P_1 := b + 2 \cdot \sqrt{\left(\frac{B - b}{2}\right)^2 + h^2}$ $P_1 = 30.093 \cdot ft$ $R_1 := \frac{A_1}{P_1}$ $R_1 = 4.308 \cdot ft$

$Q_1 := A_1 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_1}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_1 = 175.857 \cdot ft^3 \cdot sec^{-1}$ $V_1 := \frac{Q_1}{A_1}$ $V_1 = 1.357 \cdot \frac{ft}{sec}$

$A_2 := H \cdot (L - B) - s_{ex} \cdot H^2$ $A_2 = 95.057 \cdot ft^2$

$P_2 := 2 \cdot \left[\sqrt{H^2 + (s_{ex} \cdot H)^2}\right] + (L - B) - 2 \cdot s_{ex} \cdot H$ $P_2 = 94.457 \cdot ft$ $R_2 := \frac{A_2}{P_2}$ $R_2 = 1.006 \cdot ft$

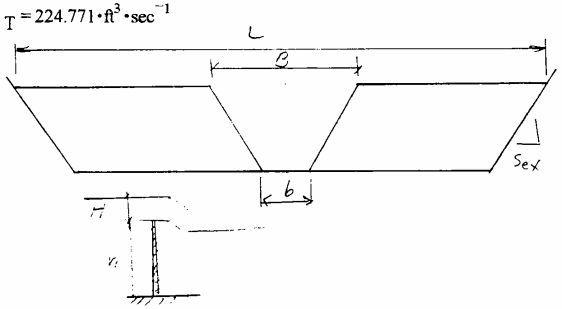
$Q_2 := A_2 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_2}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_2 = 48.914 \cdot ft^3 \cdot sec^{-1}$ $V_2 := \frac{Q_2}{A_2}$ $V_2 = 0.515 \cdot \frac{ft}{sec}$

$Q_T := Q_1 + Q_2$ $Q_T = 224.771 \cdot ft^3 \cdot sec^{-1}$

Determine H for 100-ft flood Q = 320 cfs.

H := 1.66·ft

n := 0.029 S := 0.0001 h := 7·ft



Computed by OCB

$A_1 := B \cdot H + 0.5 \cdot (b + B) \cdot h$ $A_1 = 146.117 \cdot ft^2$

$P_1 := b + 2 \cdot \sqrt{\left(\frac{B - b}{2}\right)^2 + h^2}$ $P_1 = 30.093 \cdot ft$ $R_1 := \frac{A_1}{P_1}$ $R_1 = 4.855 \cdot ft$

$Q_1 := A_1 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_1}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_1 = 214.688 \cdot ft^3 \cdot sec^{-1}$ $V_1 := \frac{Q_1}{A_1}$ $V_1 = 1.469 \cdot \frac{ft}{sec}$

$A_2 := H \cdot (L - B) - s_{ex} \cdot H^2$ $A_2 = 151.629 \cdot ft^2$

$P_2 := 2 \cdot \left[\sqrt{H^2 + (s_{ex} \cdot H)^2}\right] + (L - B) - 2 \cdot s_{ex} \cdot H$ $P_2 = 94.838 \cdot ft$ $R_2 := \frac{A_2}{P_2}$ $R_2 = 1.599 \cdot ft$

$Q_2 := A_2 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_2}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_2 = 106.236 \cdot ft^3 \cdot sec^{-1}$ $V_2 := \frac{Q_2}{A_2}$ $V_2 = 0.701 \cdot \frac{ft}{sec}$

$Q_T := Q_1 + Q_2$ $Q_T = 320.924 \cdot ft^3 \cdot sec^{-1}$

Determine H for 500-ft flood Q =384 cfs.

$H := 2.02 \cdot ft$

$n := 0.029$ $S := 0.0001$ $h := 7 \cdot ft$

$A_1 := B \cdot H + 0.5 \cdot (b + B) \cdot h$ $A_1 = 155.537 \cdot ft^2$

$P_1 := b + 2 \cdot \sqrt{\left(\frac{B - b}{2}\right)^2 + h^2}$ $P_1 = 30.093 \cdot ft$ $R_1 := \frac{A_1}{P_1}$ $R_1 = 5.168 \cdot ft$

$Q_1 := A_1 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_1}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_1 = 238.248 \cdot ft^3 \cdot sec^{-1}$ $V_1 := \frac{Q_1}{A_1}$ $V_1 = 1.532 \cdot \frac{ft}{sec}$

$A_2 := H \cdot (L - B) - s_{ex} \cdot H^2$ $A_2 = 183.422 \cdot ft^2$

$P_2 := 2 \cdot \left[\sqrt{H^2 + (s_{ex} \cdot H)^2}\right] + (L - B) - 2 \cdot s_{ex} \cdot H$ $P_2 = 95.056 \cdot ft$ $R_2 := \frac{A_2}{P_2}$ $R_2 = 1.93 \cdot ft$

$Q_2 := A_2 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_2}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_2 = 145.675 \cdot ft^3 \cdot sec^{-1}$ $V_2 := \frac{Q_2}{A_2}$ $V_2 = 0.794 \cdot \frac{ft}{sec}$

$Q_T := Q_1 + Q_2$ $Q_T = 383.924 \cdot ft^3 \cdot sec^{-1}$

Determine H for 50-yr flood Q =288 cfs.

$H := 1.46 \cdot ft$

$n := 0.029$ $S := 0.0001$ $h := 7 \cdot ft$

$A_1 := B \cdot H + 0.5 \cdot (b + B) \cdot h$ $A_1 = 140.883 \cdot ft^2$

$P_1 := b + 2 \cdot \sqrt{\left(\frac{B - b}{2}\right)^2 + h^2}$ $P_1 = 30.093 \cdot ft$ $R_1 := \frac{A_1}{P_1}$ $R_1 = 4.682 \cdot ft$

$Q_1 := A_1 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_1}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_1 = 202.026 \cdot ft^3 \cdot sec^{-1}$ $V_1 := \frac{Q_1}{A_1}$ $V_1 = 1.434 \cdot \frac{ft}{sec}$

$A_2 := H \cdot (L - B) - s_{ex} \cdot H^2$ $A_2 = 133.799 \cdot ft^2$

$P_2 := 2 \cdot \left[\sqrt{H^2 + (s_{ex} \cdot H)^2}\right] + (L - B) - 2 \cdot s_{ex} \cdot H$ $P_2 = 94.717 \cdot ft$ $R_2 := \frac{A_2}{P_2}$ $R_2 = 1.413 \cdot ft$

$Q_2 := A_2 \cdot \left(\frac{1.486}{n}\right) \cdot \left(\frac{R_2}{ft}\right)^{\left(\frac{2}{3}\right)} \cdot S^{\frac{1}{2}} \cdot \frac{ft}{sec}$ $Q_2 = 86.316 \cdot ft^3 \cdot sec^{-1}$ $V_2 := \frac{Q_2}{A_2}$ $V_2 = 0.645 \cdot \frac{ft}{sec}$

$Q_T := Q_1 + Q_2$ $Q_T = 288.342 \cdot ft^3 \cdot sec^{-1}$

Determine H.

$H := 0 \cdot ft$

$n := 0.029$ $S := 0.0001$ $h := 7 \cdot ft$

$A_1 := B \cdot H + 0.5 \cdot (b + B) \cdot h$ $A_1 = 102.679 \cdot ft^2$

$P_1 := b + 2\cdot\sqrt{\left(\frac{B-b}{2}\right)^2 + h^2}$ $P_1 = 30.093\cdot ft$ $R_1 := \frac{A_1}{P_1}$ $R_1 = 3.412\cdot ft$

$Q_1 := A_1\cdot\left(\frac{1.486}{n}\right)\cdot\left(\frac{R_1}{ft}\right)^{\left(\frac{2}{3}\right)}\cdot S^{\frac{1}{2}}\cdot\frac{ft}{sec}$ $Q_1 = 119.247\cdot ft^3\cdot sec^{-1}$ $V_1 := \frac{Q_1}{A_1}$ $V_1 = 1.161\cdot\frac{ft}{sec}$

$A_2 := H\cdot(L-B) - s_{ex}\cdot H^2$ $A_2 = 0\cdot ft^2$

$P_2 := 2\cdot\left[\sqrt{H^2 + (s_{ex}\cdot H)^2}\right] + (L-B) - 2\cdot s_{ex}\cdot H$ $P_2 = 93.833\cdot ft$ $R_2 := \frac{A_2}{P_2}$ $R_2 = 0\cdot ft$

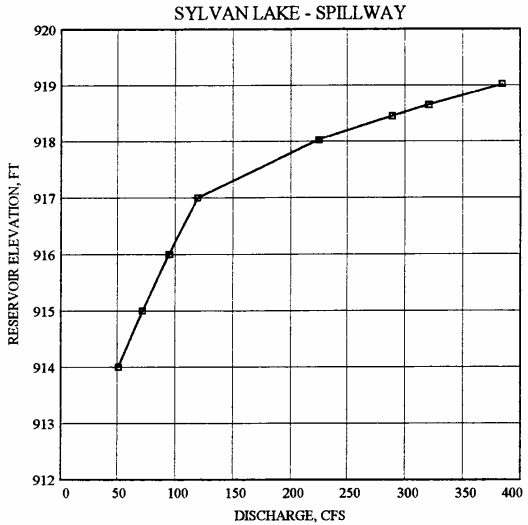
$Q_2 := A_2\cdot\left(\frac{1.486}{n}\right)\cdot\left(\frac{R_2}{ft}\right)^{\left(\frac{2}{3}\right)}\cdot S^{\frac{1}{2}}\cdot\frac{ft}{sec}$ $Q_2 = 0\cdot ft^3\cdot sec^{-1}$ $V_2 := \frac{Q_2}{A_2}$ $V_2 = 0\cdot\frac{ft}{sec}$

$Q_T := Q_1 + Q_2$ $Q_T = 119.247\cdot ft^3\cdot sec^{-1}$

$j := 1..8$

EL		Q	
914	no flow at El. 917	50	
915		71	
916		94	
917		119	
918.03	10 year flood	224	
918.46	50 year flood	288	
918.66	100 year flood	320	
919.02	500 year flood	384	

EL := ·ft Q := ·$\frac{ft^3}{sec}$


SYLVAN LAKE - SPILLWAY
RESERVOIR ELEVATION, FT
920
919
918
917
916
915
914
913
912
0
50
100
150
200
250
300
350
400
DISCHARGE, CFS

Depth of scour below Tailwater: $HW := 918.66$ 100 Year Flood $TW := 916$ $L := 120$

$H := (HW - TW)$ $H = 2.66$ $Q := 320$ $q := \frac{Q}{L}$ $q = 2.667$

$D := 1.32 \cdot H^{0.225} \cdot q^{0.54}$ $D = 2.794$

$EL_{scour} := TW - D$ $EL_{scour} = 913.206$

Bottom of channel $EL_{channel} := 910$ No bottom scour

Design of the Concrete Lining

$t := 6 \cdot in$ $\gamma_c := 150 \cdot \frac{lb}{ft^3}$ $\alpha := \operatorname{atan}\left(\frac{1}{1.5}\right)$ $\alpha = 33.69 \cdot deg$

$W := t \cdot \gamma_c$ $W = 75 \cdot lb \cdot ft^{-2}$ $N := W \cdot \cos(\alpha)$ $N = 62.404 \cdot lb \cdot ft^{-2}$

$T := W \cdot \sin(\alpha)$ $T = 41.603 \cdot lb \cdot ft^{-2}$ $\mu := 0.60$ Ultimate friction coef. for dense gravel

$R := \mu \cdot N$ $R = 37.442 \cdot lb \cdot ft^{-2}$ less than $T = 41.603 \cdot lb \cdot ft^{-2}$ No good

Provide anchor and key $FS := 1.5$

$R_{req} := FS \cdot T - R$ $R_{req} = 24.962 \cdot lb \cdot ft^{-2}$

Key of 12" $L := 16.2 \cdot ft$ $b := 6 \cdot ft$ $\sigma_{al} := 200 \cdot \frac{lb}{ft^2}$

Total for 16.2 x 6 ft $R_{req} := R_{req} \cdot 16.2 \cdot 6 \cdot ft^2$ $R_{req} = 2.426 \cdot 10^3 \cdot lb$ $d_k := 1 \cdot ft$

Rebar

Lateral bearing stress $\sigma_{lbrg} := \frac{R_{req}}{b \cdot d_k}$ $\sigma_{lbrg} = 404.376 \cdot lb \cdot ft^{-2}$ > 200 no good

Provide Nelson stud to anchor

$Pa := R_{req} - \sigma_{al} \cdot b \cdot d_k$ $Pa = 1.226 \cdot 10^3 \cdot lb$ $f_s := 10 \cdot ksi$

5/8" dia anchor $A_{anchor} := \frac{Pa}{f_s}$ $A_{anchor} = 0.123 \cdot in^2$

Use 5/8" dia. x 4" nelson stud at 18" oc.

$A_s := 0.00125 \cdot t \cdot 12 \cdot in$ $A_s = 0.09 \cdot in^2$ Use #4 @ 12 oc

Design of Cantilevered Sheet Pile Wall - Granular Soil

File: Shetpile.mcd **C. C. Baile**

UNITS: $lb \equiv 1M$ $sec \equiv 1T$ $ft \equiv 12 \cdot in$

$psi \equiv \frac{lb}{in^2}$ $ksi \equiv 1000 \cdot psi$ $g \equiv 32.2 \cdot \frac{ft}{sec^2}$ $kips := 1000 \cdot lb$

GIVEN:

Material Properties **ASTM A328 REGULAR CARBON GRADE**

$f_y := 38.5 \cdot ksi$ $f_s := 25 \cdot ksi$

Fill and Foundation: **Foundation: dense gravel 95% or greater proctor density**
Fill: mostly sand sediments

$\phi := 35 \cdot deg$ $\delta := 17 \cdot deg$ $\beta := 0$

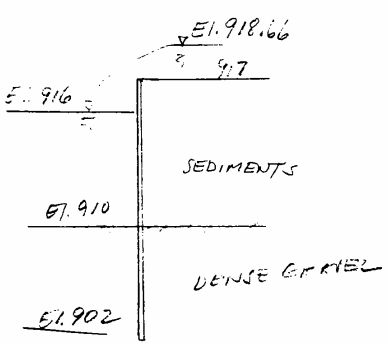
Fill: $\gamma_{fill} := 110 \cdot \frac{lb}{ft^3}$ **Foundation:** $\gamma_{ftn} := 65 \cdot \frac{lb}{ft^3}$

Wall: $H := 7 \cdot ft$ **< 14 ft> use anchored sheet pile** $b_w := 1 \cdot ft$

Water Levels: $h_{ds} := 6 \cdot ft$ $h_{us} := 8.66 \cdot ft$ $\gamma_w := 62.4 \cdot \frac{lb}{ft^3}$

$h_v := 1.66 \cdot ft$

Find: **Determine the embedment length of sheet pile and size.**



When the water level at backfill side is above top of fill and the other side is lower.

$\phi = 35 \cdot deg$ $\delta = 17 \cdot deg$ $H = 7 \cdot ft$ $\gamma_{fill} = 110 \cdot lb \cdot ft^{-3}$ $\gamma_{ftn} = 65 \cdot lb \cdot ft^{-3}$

$h_{ds} = 6 \cdot ft$ $h_{us} = 8.66 \cdot ft$ $h_v = 1.66 \cdot ft$ $f_y = 38.5 \cdot ksi$ $f_s = 25 \cdot ksi$

1. Calculate earth coefficient.

Depth of embedment: $D := 7.312 \cdot ft$

$$K_a := \frac{\cos(\phi)^2}{\cos(\delta) \cdot \left(1 + \sqrt{\sin(\phi + \delta) \cdot \sin(\phi - \beta)}\right)^2} \qquad K_a = 0.251 \qquad K_a := 0.27$$

$$K_p := \frac{\cos(\phi)^2}{\cos(\delta) \cdot \left(1 - \sqrt{\sin(\phi + \delta) \cdot \sin(\phi - \beta)}\right)^2} \qquad K_p = 6.534 \qquad K_p := 6.56$$

$K_{pa} := K_p - K_a$ $K_{pa} = 6.29$

2. Determine soil pressures. $\gamma_{fill} := \gamma_{fill} - \gamma_w$ **submerged fill**

$PA_1 := \gamma_{fill} \cdot K_a \cdot H$ $PA_1 = 89.964 \cdot lb \cdot ft^{-2}$

$PA_2 := PA_1 + \gamma_{ftn} \cdot D \cdot K_a$ $PA_2 = 218.29 \cdot lb \cdot ft^{-2}$

$PE := \gamma_{ftn} \cdot D \cdot K_{pa} - PA_1$ $PE = 2.9 \cdot 10^3 \cdot lb \cdot ft^{-2}$

$PJ := \gamma_{ftn} \cdot D \cdot K_{pa} + \gamma_{fill} \cdot K_p \cdot H$ $PJ = 5.175 \cdot 10^3 \cdot lb \cdot ft^{-2}$

3. Determine water load.

$\Delta h := h_{us} - h_{ds}$

Horizontal forces from water load.

$Pw_1 := \gamma_w \cdot h_v \cdot (\Delta h - h_v) \cdot b_w$ $Pw_1 = 103.584 \cdot lb$

$Pw_2 := 0.5 \cdot \gamma_w \cdot (\Delta h - h_v)^2 \cdot b_w$ $Pw_2 = 31.2 \cdot lb$

$Pw_3 := \gamma_w \cdot \Delta h \cdot h_{ds} \cdot b_w$ $Pw_3 = 995.904 \cdot lb$

$Pw_4 := \gamma_w \cdot \Delta h \cdot D \cdot b_w$ $Pw_4 = 1.214 \cdot 10^3 \cdot lb$

$\Sigma Pw := Pw_1 + Pw_2 + Pw_3 + Pw_4$ $\Sigma Pw = 2.344 \cdot 10^3 \cdot lb$

Moment from water load about the bottom end of pile.

$$\Sigma Mw := Pw_1 \cdot \left[0.5 \cdot (\Delta h - h_v) + h_{ds} + D\right] + Pw_2 \cdot \left(\frac{\Delta h - h_v}{3} + h_{ds} + D\right) + Pw_3 \cdot \left(\frac{h_{ds}}{2} + D\right) + \frac{Pw_4 \cdot D}{2}$$

$\Sigma Mw = 1.656 \cdot 10^4 \cdot lb \cdot ft$

3. Sum of horizontal forces equals zero:

$$\frac{1}{2}\cdot H\cdot PA_1 + \left(PA_1 + PA_2\right)\cdot\frac{D}{2} + (PE + PJ)\cdot\frac{Z}{2} + \Sigma PW - \left(PE + PA_2\right)\cdot\frac{D}{2} = 0$$

$$Z := \frac{\left(PE - PA_1\right)\cdot D - H\cdot PA_1}{PE + PJ} \qquad Z = 2.466\cdot ft$$

4. Sum of moment about any point, F, equals zero.

$D := 5\cdot ft$ Given

$$\left[\frac{1}{2}\cdot H\cdot PA_1\cdot\left(D + \frac{H}{3}\right) + \frac{PA_1\cdot D^2}{2} + \frac{\left(PA_2 - PA_1\right)\cdot D^2}{6} + \frac{(PE + PJ)\cdot Z^2}{6} + \frac{\Sigma Mw}{b_w} - \frac{\left(PE + PA_2\right)\cdot D^2}{6}\right]\cdot b_w = 0$$

$D := \text{Find}(D)$ $D = 7.853\cdot ft$

5. The required embedment with FS (1.2 to 1.4): $D := 1.285\cdot D$ $D = 10.092\cdot ft$

< 1.33

6. Maximum moment and sheet pile size

Locate point of zero shear.

Below the dredgeline: $y := \frac{PA_1}{\gamma_{ftn}\cdot K_{pa}}$ $y = 0.22\cdot ft$

$P_1 := \frac{1}{2}\cdot PA_1\cdot H\cdot b_w$ $P_1 = 314.874\cdot lb$

$P_2 := \frac{1}{2}\cdot PA_1\cdot y\cdot b_w$ $P_2 = 9.898\cdot lb$

$Pw_1 = 103.584\cdot lb$ $Pw_2 = 31.2\cdot lb$ $Pw_3 = 995.904\cdot lb$

$Pwy := \gamma_w\cdot\Delta h\cdot y\cdot b_w$ $Pwy = 36.523\cdot lb$

$\Sigma Px := Pw_1 + Pw_2 + Pw_3 + Pwy + P_1 + P_2$ $\Sigma Px = 1.492\cdot 10^3\cdot lb$

Distance below point of zero shear.

$X := 1\cdot ft$ Given $\frac{\gamma_{ftn}\cdot K_{pa}\cdot X^2}{2}\cdot b_w - \gamma_w\cdot\Delta h\cdot X\cdot b_w = \Sigma Px$

$X := \text{Find}(X)$ $X = 3.138\cdot ft$

Maximum moment

$P_3 := \frac{1}{2} \cdot \gamma_{ftn} \cdot K_{pa} \cdot X^2 \cdot b_w$ $P_3 = 2.013 \cdot 10^3 \cdot lb$ $Pwx := \gamma_w \cdot \Delta h \cdot X \cdot b_w$

$\Sigma Px := Pw_1 + Pw_2 + Pw_3 + Pwy + P_1 + P_2 + Pwx$ $\Sigma Px = 2.013 \cdot 10^3 \cdot lb$

$L_1 := \frac{H}{3} + y + X$ $L_2 := \frac{2 \cdot y}{3} + X$

$L_3 := \frac{X}{3}$ $L_4 := 0.5 \cdot \left(\Delta h - h_v\right) + h_{ds} + y + X$

$L_5 := \frac{\Delta h - h_v}{3} + h_{ds} + y + X$ $L_6 := 0.5 \cdot h_{ds} + y + X$

$L_7 := X + 0.5 \cdot y$ $L_8 := \frac{X}{2}$

$M_{max} := P_1 \cdot L_1 + P_2 \cdot L_2 - P_3 \cdot L_3 + Pw_1 \cdot L_4 + Pw_2 \cdot L_5 + Pw_3 \cdot L_6 + Pwy \cdot L_7 + Pwx \cdot L_8$

$M_{max} = 8.31 \cdot 10^3 \cdot lb \cdot ft$

Section modulus: $S := \frac{M_{max}}{f_s}$ $S = 3.989 \cdot in^3$ **PER FOOT OF WALL**

USE SHEET PILE PMA22, S=5.4 IN³ PER FT OF WALL·, 22 LB/SQ.FT., ASTM A328 CARBON GRADE , 8'-0" EMBEDMENT IN TO DENSE GRAVEL.

PROGRAM CSHTSSI - SOIL-STRUCTURE INTERACTION ANALYSIS
OF CANTILEVER OR ANCHORED SHEET PILE RETAINING WALLS
DATE: 97/07/10 TIME: 23.34.47

I.--INPUT DATA

1.--HEADING

'SHEET PILE SPILLWAY
'SYLVAN LAKE ENHANCEMENT

2.--WALL DATA

ELEVATION AT TOP OF WALL	=	917.00	(FT)
ELEVATION AT BOTTOM OF WALL	=	902.00	(FT)
WALL MODULUS OF ELASTICITY	=	29.0E+06	(PSI)
WALL MOMENT OF INERTIA	=	13.70	(IN**4)
WALL CROSS SECTION AREA	=	6.48	(SQIN)

3.--ANCHOR DATA
NONE

--RIGHTSIDE SOIL DATA

LAYER NO	TOP ELEV AT WALL (FT)	UNIT WEIGHT (PCF)	INTERN FRICT (DEG)	COH-HESION (PSF)	WALL FRICT (DEG)	AT-REST COEFF	SOIL MODULUS (PCI)	INTERACT DISTANCE (FT)
1	917.00	110.00	30.00	.00	11.00	.50	20.00	7.00
2	910.00	125.00	35.00	.00	17.00	.50	80.00	8.00

5.--LEFTSIDE SOIL DATA

LAYER NO	TOP ELEV AT WALL (FT)	UNIT WEIGHT (PCF)	INTERN FRICT (DEG)	COH-HESION (PSF)	WALL FRICT (DEG)	AT-REST COEFF	SOIL MODULUS (PCI)	INTERACT DISTANCE (FT)
1	910.00	125.00	35.00	.00	17.00	.50	80.00	8.00

6.--WATER DATA

WATER UNIT WEIGHT	=	62.50	(PCF)
RIGHTSIDE WATER ELEVATION	=	918.66	(FT)
LEFTSIDE WATER ELEVATION	=	916.00	(FT)

7.--SURFACE SURCHARGE LOADS
NONE

8.--HORIZONTAL LINE LOADS
NONE

9.--HORIZONTAL APPLIED PRESSURES
NONE

PROGRAM CSHTSSI - SOIL-STRUCTURE INTERACTION ANALYSIS
OF CANTILEVER OR ANCHORED SHEET PILE RETAINING WALLS
DATE: 97/07/10 TIME: 23.35.04

II.--NONLINEAR CURVE DATA GENERATED BY CSHTSSI

II.A.--HEADING
'SHEET PILE SPILLWAY
'SYLVAN LAKE ENHANCEMENT

II.B.--ANCHOR NONLINEAR SPRING DATA
NONE

II.C.--RIGHTSIDE SOIL NONLINEAR SPRING DATA

ELEVATION 917.00 (FT)		ACTIVE	AT-REST	PASSIVE
	DISPLACEMENT (FT):	1.0000E+03	0.0000E+00	-1.0000E+03
	PRESSURE (PSF) :	.00	.00	.00
ELEVATION 910.00 (FT)		ACTIVE	AT-REST	PASSIVE
	DISPLACEMENT (FT):	1.8587E-03	0.0000E+00	-3.6481E-02
	PRESSURE (PSF) :	102.01	166.25	1427.03
ELEVATION 910.00 (FT)		ACTIVE	AT-REST	PASSIVE
	DISPLACEMENT (FT):	9.1722E-04	0.0000E+00	-2.4177E-02
	PRESSURE (PSF) :	81.93	166.25	2388.82
ELEVATION 902.00 (FT)		ACTIVE	AT-REST	PASSIVE
	DISPLACEMENT (FT):	9.1722E-04	0.0000E+00	-2.4177E-02
	PRESSURE (PSF) :	205.13	416.25	5981.04

II.D.--LEFTSIDE SOIL NONLINEAR SPRING DATA

ELEVATION 910.00 (FT)		PASSIVE	AT-REST	ACTIVE
	DISPLACEMENT (FT):	1.0000E+03	0.0000E+00	-1.0000E+03
	PRESSURE (PSF) :	.00	.00	.00
ELEVATION 902.00 (FT)		PASSIVE	AT-REST	ACTIVE

DISPLACEMENT (FT): 2.4177E-02 0.0000E+00 -9.1722E-04
PRESSURE (PSF) : -3592.22 -250.00 -123.20

PROGRAM CSHTSSI - SOIL-STRUCTURE INTERACTION ANALYSIS
OF CANTILEVER OR ANCHORED SHEET PILE RETAINING WALLS
DATE: 97/07/10 TIME: 23.35.16

III.--SUMMARY OF RESULTS

III.A.--HEADING
'SHEET PILE SPILLWAY
'SYLVAN LAKE ENHANCEMENT

III.B.--MAXIMA

	MAXIMUM POSITIVE	ELEV (FT)	MAXIMUM NEGATIVE	ELEV (FT)
AXIAL DISPLACEMENT (IN) :	0.00E+00	917.00	0.00E+00	917.00
LATERAL DISPLACEMENT (IN):	3.33E+00	917.00	-1.36E-01	902.00
AXIAL FORCE (LB) :	0.00E+00	917.00	0.00E+00	917.00
SHEAR (LB) :	2.73E+03	904.00	-1.56E+03	909.50
BENDING MOMENT (LB-FT) :	0.00E+00	917.00	-8.33E+03	906.50

IV.--COMPLETE RESULTS

IV.A.--HEADING
'SHEET PILE SPILLWAY
'SYLVAN LAKE ENHANCEMENT

IV.B.--COMPLETE RESULTS

ELEV (FT)	<----DEFLECTIONS---> AXIAL (IN)	LATERAL (IN)	AXIAL FORCE (LB)	SHEAR (LB)	BENDING MOMENT (LB-FT)	SOIL PRESSURE (PSF)
917.00	0.00E+00	3.33E+00	0.	0.	0.	.00
916.00	0.00E+00	3.01E+00	0.	-142.	-65.	14.57
915.00	0.00E+00	2.68E+00	0.	-330.	-300.	29.15
914.00	0.00E+00	2.37E+00	0.	-533.	-730.	43.72
913.00	0.00E+00	2.05E+00	0.	-750.	-1371.	58.29
912.00	0.00E+00	1.74E+00	0.	-982.	-2236.	72.87
911.00	0.00E+00	1.44E+00	0.	-1229.	-3340.	87.44
910.00	0.00E+00	1.16E+00	0.	-1490.	-4698.	102.01
910.00	0.00E+00	1.16E+00	0.	-1490.	-4698.	81.93
909.00	0.00E+00	8.92E-01	0.	-1521.	-6239.	-351.70
908.00	0.00E+00	6.54E-01	0.	-1119.	-7595.	-785.32
907.00	0.00E+00	4.49E-01	0.	-283.	-8332.	-1218.95
906.00	0.00E+00	2.81E-01	0.	1010.	-8009.	-1597.22
905.00	0.00E+00	1.46E-01	0.	2182.	-6367.	-1048.52
904.00	0.00E+00	3.89E-02	0.	2725.	-3855.	-348.95
903.00	0.00E+00	-5.16E-02	0.	2196.	-1241.	1192.06
902.00	0.00E+00	-1.36E-01	0.	0.	0.	2903.59

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